RAILROAD GAZETTE

FRIDAY, JUNE 27, 1902.

CONTENTS

The International Association for Testing Materials.

In our issue of June 20, page 473, was a partial report of the Atlantic City meeting of the American Section of the International Association for Testing Materials. We gave there the officers elected, the list of papers and topics, and a report of the discussion on the question of specifying a single grade of structural steel for bridges, etc.

In our issue of June 13, page 448, appeared a paper by Mr. Albert Sauveur, which was presented at the same meeting, under the title of Structure and Finishing Temperature of Steel Rails. A report of the discussion of that paper follows:

STRUCTURE AND FINISHING TEMPERATURE OF RAILS.

P. H. Dudley (Consulting Engineer).—Mr. Sauveur in his valuable paper, by treating the subject as a general proposition, without mentioning any of the relations a rail sustains by its section and stiffness to railroad service and interests, perhaps condenses his paper too much, for it will be read rather in an educational than a technical sense by a majority of readers.

Many will infer that colder rolling is the only important requisite now required to make rails which will meet the demands of present service, reducing the loss of metal by wear to as slow a rate as was the case on the early Bessemer steel rails of two decades ago under the lighter wheel loads. This would be a return to the practice which then prevailed with the limited output, and a price of rails of three to four times the present cost.

Besides a return to the slower and consequently colder rolling from the small ingots of the early Bessemer steel rails which replaced iron, a sound ingot is needed of a grade of steel which will produce the essential physical properties for the rails as girders and also insure a slow rate of wear.

It should not be forgotten that while we are all familiar with the rapid doubling and trebling of the wheel loads in the past decade, the strains in the rails as girders are principally met by elasticity of length, while the increased intensities of the wheel pressures per unit of contact between the wheel treads and the rail heads are sustained more by the elasticity of volume, which is quickly reduced by the slightest unsoundness of the metal in the surface of the rail head. Therefore, to have the most benefit from colder rolling or heat treatment the metal must be sound and homogeneous.

The evolution of the present up-to-date steel mill has been more in the direction of increasing the output and decreasing the cost of the product than of any intention of decreasing the quality of the finished rails. The mechanical conditions for an increased output have received most of the consideration. . . . There does not seem to be any reason why the construction of a rail mill is not possible which will permit not only much colder rolling and finishing temperatures than are now general, without restriction of the output, but turn out a more uniform and better finished section than is now produced. The standards of smoothness of track are now much higher than a decade ago on all of the important trunk lines, and they have not reached their limit. The smoothness of the surface of the rails rather than its wear now determines when they must be replaced.

Mr. Sauveur states several facts, principles, which he says are old and well-known, particularly the one stated by Professor Tschernoff in April and May, 1868. This was the period of active substitution of Bessemer steel rails in this country, some of the first having been put into service in 1863. Crucible steel had been tried in a limited way for the purpose of securing a fine grained and homogeneous metal for wear. Booth's crucible steel capped rail head was tried extensively to secure a portion of the head of fine grained material for wear, the balance of the section being of iron. Both practically and technically it may be said to have been recognized by many people for a long time that for the slowest rate of wear in the heads of rails the metal should be fine grained. Experience has confirmed this and also the important fact that the metal must be sound and homogeneous. . . .

In the first paragraph and the first sentence of the second of Mr. Sauveur's paper, he states, as he says, well known facts. The statements are generally true as applied to blooms or material which has been rolled from the ingot, but do not cover all the work to be done when rolling rails direct from the ingots, or to blooms. The fluid steel of about 1450 deg. C. is tapped from the teaming ladle into the mould, the steel on congealing forms a decided columnar structure interiorly from the sides of the iron-moulds of one to one and a half inches in thickness, the interior mass crystallizing in the usual granular or polyhedral forms. The ingots after cooling 15 to 20 minutes are set sufficiently to be stripped, and are then placed in furnaces or soaking pits until the heat of the interior and exterior portions of the ingot is sufficiently equalized at about 1100 deg. C. or 1150 deg. C. for blooming. The work of the blooming passes breaks up the coarse columnar structure though rarely without several skin cracks occurring, which, though not completely, roll out partially in the roughing and finishing passes for the rails. Some "seconds" are produced, the percentage being high when exceeding five or six per cent.

It requires close attention to the composition and manufacture to produce an ingot with a columnar structure that will withstand the subsequent heating and blooming without cracking. "Cobbles" are not infrequent. If the rolling is direct from the ingot to the finished rail, then the work of the passes must break up not only the ingot structure, which seems to be done before or during the "dummy" pass, but prevent the building up of a coarse structure until the work ceases. This should be near or slightly below the critical temperature for the given composition. Rolling or forging can not only break up a structure during "hot work," but check a large crystallization to the critical temperature for the steel.

"Hot work" influences the final texture of steel by breaking up the ingot or bloom structure, as the case may be, reducing the steel to a plastic or possibly a porcelanic condition, and by eliminating the essential time element for the crystalline forces to rearrange the combinations retards crystallization from a higher to the critical temperature for the composition.

This important principal, so clearly set forth in other words in Mr. Sauveur's paper, is the keynote of practice to be observed to improve the quallity of steel rails during the period of *proper hot work*. It can be so well applied in practice as not to restrict the output. Rolling may be continued some 50 deg. or 60 deg. C. below the critical temperature without sufficient loss of ductility to be of moment.

"Blue working" is not advisable, though below this temperature the steel again increases in tensile strength, then reducing slightly as it reaches 30 deg. C.

Some of the early foreign Bessemer steel rails were rolled until the critical temperature in the head was passed, while one firm toughened their rails. In regard to ductility I place more restriction upon it than Mr. Sauveur does. In rails I insist upon high elastic limits in the metal and then the requisite ductility for safety and good wear of the rail heads. Rail loads must perform the functions of continuous girders, and we are limited as to the amount of ductility we may give the metal for rails. The rails must be elastic and should have high elastic limits 55,000 to 60,000 lbs. and then have the requisite ductility and fine grained structure in the metal for wear. Unit fiber stresses in the base of rails under high speed trains, even in 80-lb. rails of 45,000 lbs. in tension, are not uncommon.

The introduction of stiffer rails as girders in the tracks and the higher standards of maintenance possible have permitted the doubling of the driving wheel axle loads, the tractive power of the locomotives, the passenger train loads and increased the freight train load four to six times during the past decade.

The steam pressures have been increased from 135 to 205 lbs., due to the use of steel in locomotive boilers and the latter increased in capacity, so they can generate and maintain an expenditure of 1,200 to 1,500 horsepower at 60 and 65 miles per hour. Such service is only possible on the stiffer and heavier rails of the present.

It is a fact now known but not generally understood that the stresses in the rails increase decidedly under the large expenditures of tractive power, beside that due to the weight and speed of the locomotive. With the increased service which has followed the introduction of the heavier and stiffer rails there has been a legitimate increased wear of the head, while there has been some increased wear due to the quality of the product. The increased axle and train loads have resulted in a decrease of operating and maintenance expenses, so that from the financial standpoint it is found desirable to use the stiffer and heavier rails. The demand for such rails at the present time (1902) exceeds the output of the mills, and any manipulation of the process of manufacture which will limit the output is not likely to receive much consideration. There is no reason, however, why the output need be limited to insure much colder rolling or the manufacture of a fine grained rail.

Rails rolled direct from the ingot have a finer texture, as would be expected, than those from the same composition rolled from re-heated blooms. The shrinkage allowances now prescribed for 80 and 100 lb. rails are yet in excess of the allowance for the former lighter rails, and some reduction in the future may be expected. . . .

Robert Job (Chemist, Philadelphia & Reading R. R.) —In connection with the term "finishing temperature," we often find a good deal of apparent misconception, and it seems desirable, at the risk of repetition, to state that the low finishing temperature desired is a temperature near the critical point at the time when thorough working of the steel ceases. To secure the best results, as stated, it does not appear sufficient to carry on 95 per cent. of the reduction at a relatively high temperature, and only 5 per cent. at the lower temperature, and it has been shown by Mr. S. S. Martin, and also by results presented a month ago at the joint meeting of the Franklin Institute and of the American Institute of Mining Engineers at Philadelphia, that such procedure toughens the steel merely to the depth to which working extends during such last reduction, and that the condition at center of head is practically unchanged.

RAIL TEMPERATURES.

S. S. Martin (Sup't Steel Dep't, Maryland Steel Co.)—There are vastly different ideas as to actual temperature found in a rail after leaving the finishing or final pass, and these ideas expressed in actual figures run from 750° C. to 1100° C., according to the different methods used to determine same; as far as I know the methods are: 1st, pyometric telescope; 2nd, Le Chatelier pyrometer, and 3rd, water calorimeter. The pyrometric telescope depends on the eye of the operator for results, hence is influenced by the mind to such an extent that different operators observing the same bar get very different results.

The Le Chatelier pyrometer, the only truly scientific pyrometer, has been applied to determining rail temperatures by placing the couple on piece of the rail (cut just after leaving the final pass) near the center of the head, which is likely to give irregular temperatures, on account of different amount of heat through head of rail.

Water Calorimeter.—This method consists in using the barrel calorimeter and the following obtained: 1st, weight of water in calorimeter; 2nd, temperature before emersion; 3rd, temperature after emersion; 4th, weight of rail end. Now instead of using the usual formula which is for lower temperatures, and as we do not have the specific heat for steel at high temperature, we use the formula given in Anneles de Chenie et de Physique, series No. 6, vol. No. 2, and page No. 72 (1887), we find the formula for specific heat of pure iron of 723° C. to 1000° C.:

Q (Given out to 0°) = 0.218 t — 39

and for 1000° C. to 1158° C.

Q (Given out to 0°) = 1989 t (—) 23.44

Example:—Crop weighs 22.5 lbs. and heats up 104.5 lbs. of from 19° C. to 49.5° C., then,

Total given out 104.5 × 30.5 = 3187.2 Cal.

Total given out per lb. of steel = 141.6 Cal.

One lb. of steel gives out in falling from

49.5° C. to 0° (49.5 × .118) =	5.8
Q (Given out to 0) =	147.4
147.4 =	0.218 t — 39
.218 t =	186.4
t =	855

By making corrections, for heat lost to calorimeter during the time the temperature is rising, both by the water value of the calorimeter and heat radiated, as well as noting that the formula is for pure iron, or iron free from carbon so that it will be necessary when the steel was more than ¼ per cent. to make allowance for same, say steel has .50 carbon then we would say 100.5 × weight of steel, results are accurate.

This method gives excellent results, and to check their accuracy I used the following method: A Le Chatelier pyrometer was used for measuring the heat in a small furnace in which a rail end was heated. When to the desired temperature, the rail end was taken out and placed in a calorimeter and thus, the two methods checked within 20 C., in a number of trials for temperatures. I find the shrinkage of 5¾ in. to 6¼ in. will show temperature between 780 deg. C., and 800 deg. C. I find that this gives a very accurate method for determining temperatures when it is desired to do so, and easily applicable at all times to mill practice.

Mr. Sauveur's three micro-photos showing 0.50 carbon steel forged at known temperatures of 600 C., 850 C., and 1100 C., gives an excellent chance to obtain by the microscope the temperature at which a rail left the final pass, and seems to me to be far ahead of any shrinkage, or other method that can be introduced for telling the final temperature.

Direct rolling temperatures as compared with reheating temperatures.

Mills rolling direct (of which there are a few in this country, and all mills I think abroad) have the advantage of reheating mills, and at same time temperatures are within a closer range, because ingots are more uniformly heated than blooms if properly handled, as is the case in an up-to-date modern plant. When I speak of heating ingots which have been charged hot, I simply mean of allowing them to equalize in the furnace, hence it would be proper to say, "equalizing furnace."

It is known that mills built to roll direct are of heavier construction, with heavier rolls that will stand the harder work of colder rolling, and as tonnage increases and forcing of steel through mill faster, which condition arises at every mill, the proper procedure is to try and keep uniform structure, which can often be done, as I know of a case in particular where tonnage went from 900 tons per 24 hours to 1,750 tons, and structure has been kept the same.

The structure is better in direct rolling, because the bloom goes through the whole of the "rail" rolls at a lower temperature, while in a reheating mill where the bloom has had a "wash heat" and rolled at high temperature to the final pass, and then held sufficiently to get the desired shrinkage, the result is a "case-hardened rail," a fine skin and a very granular interior which certainly is rolled at or under the critical period, and if the latter, only tends to pull asunder the granules, and if this actually does not produce rupture, sets up such strains that will under certain impact produce fracture or failure as shown on micro-photos of a rail in which the side of the head left the projected web on account of the weak cleavage caused by the big faces of the crystals. This was on 85-lb., American Society rail in track three months, and rolled by the holding before the final pass so as to get required shrinkage. For this reason it seems important that a rail shall have structure nearer homogeneous throughout the head. I fully believe that it is important to reach as near as possible the critical point, obtained by work, continuously from ingot through the final pass.

Micro-photos also show a bar rolled very hot to the final pass and there held until it had 6½ in. shrinkage in 33 ft., while another was rolled through the mill at a lower temperature with 7-in. shrinkage and structure better than the other of 6½ in. So it can truly be said, low shrinkage does not mean good structure, as microscopes will fully show.

In comparing a number of drop tests of rails rolled direct and reheated, held at final pass that there is considerable more deflection found in the rails held before the final pass. The Pennsylvania Railroad raised their maximum deflection in their specifications last year to 2¾ in., so that heats might not be rejected that showed such tendencies the year before.

From this it shows that there is some reason for this decided difference, and as both rails have the same chemical composition, as limits are given for these, it would seem that the direct rolled rail would have the higher elastic limit. This condition will probably be explained by Mr. Sauveur's disposition of the result obtained by holding before the final pass.

Summing up it would seem that shrinkage is certainly not an index of structure, and the only way to determine structure is through microscopic investigation of the work of individual mills.

The Master Mechanics' Reports.

TON-MILE STATISTICS.

Comparison of Statistics.—Only those who have had the experience can appreciate the influence of water, fuel, weather conditions, grades, curvatures and climate on the cost of operating. Any one of these elements may easily produce a difference in cost which will surprise the uninitiated. Take the item of grade. Assume that 5 lbs. is the drawbar pull necessary to keep a ton of train in motion at a speed of eight miles per hour on a level track. The introduction of a grade as slight as one-fourth of one per cent., or 13.2 ft. per mile, doubles the resistance per ton, reducing the capacity of a given locomotive from 1,000 to 500 tons, and doubling the operating and motive power costs per ton-mile.

By far the largest proportion of the uncertainty is eliminated when a comparison is made of the statistics of a given division or system with those of the same territory for a corresponding previous period. In such a comparison the conditions are the same, or any change is known, making it possible to draw fairly reliable conclusions from a comparison of statistics. It was, no doubt, this line of reasoning and the experience of the members of the Association growing out of unjust conclusions drawn from a comparison of statistics made under dissimilar conditions, which led the American Railway Master Mechanics' Association to unanimously pass the following resolution at its session in June, 1901:

"Resolved, That it is the sense of this Association that a strict comparison of motive power statistics, one road with another, will not secure the best results, but that such comparison should be made with the records of the same division for preceding periods of time."

It would be a mistake to assume from the foregoing that it is the intention to urge that a comparison of the statistics of different railroads should not be made, or if made, that they will be of no value. The intent is to call attention to the fact that conclusions based on such a comparison may easily prove incorrect. They are fair only when the accompanying conditions are fairly well-known, and that the comparison of the statistics of a division or system with those of the same territory for a previous corresponding period, very largely eliminates the uncertainties, and makes conclusions based on such a comparison very much more reliable. . . .

Units of Statistics.—Of late it has been suggested a number of times that the unit of statistics should measure the work done still more closely by including the only element of the horse-power lacking in the ton-mile, namely, speed. One such suggestion has been made in substance as follows: "The theoretical maximum horse-power of a locomotive can be calculated. A comparison of the actual horse-power obtained in service, with the possible horse-power, would furnish a closer measure of operating efficiency than a comparison of actual and possible ton-mileage." It is very doubtful if those who reason in this way have an adequate conception of the cost and difficulties involved in determining the actual power developed. It would involve determining the average drawbar pull behind the tender, and the average speed between locomotive terminals for each locomotive in service. To do this at all accurately would necessitate the use of a combined dynamometer and speed recorder, which would automatically register the pull, push and speed; one of these instruments for each end of each locomotive. . . . Assuming that such an instrument is available, it will be necessary that it be a calculating machine, and register the *average* pull and speed, or these factors must be determined after the records are made, in order to determine the horse-power developed. Assuming that we have the average pull and speed, no matter how obtained, these must be multiplied together, and the product by the distance through which the pull was exerted, and then divided by 33,000 to find the desired horse-power. It is evident that the problem is a difficult and costly one to solve. It is at least safe to assume that its immediate solution is not probable, and the plan need not be considered for use in making up the statistics of the next few years. It would seem more practicable to determine the average speed of trains from the train sheets, or by means of a speed register in the caboose, but it is very doubtful if the resulting horse-power would be a much better basis than the ton-mile. . . . It would seem wise to postpone the introduction of a unit of statistics, including the average speed, until it has been shown that the use of the ton-mile unit has accomplished all that is possible in increased efficiency, and that a horse-power will secure further economies. Meanwhile it seems reasonable to believe that a grouping of statistics, according to speeds, will make up considerably for the fact that the ton-mile unit does not include the element of speed. The matter of grouping statistics will be discussed somewhat more fully farther on. . . .

Passenger Service.—The usual argument advanced by those who do not use the ton-mile basis for passenger locomotive statistics is that the speed and weight of passenger trains are not under the control of division officials, but are fixed by general officers not immediately responsible for results, whose decisions are controlled by competitive necessities, implying there is little use in trying to improve records in this service, and therefore little use for accurate statistics. Assuming this to be a valid reason, the logical deduction to be made is that passenger locomotive statistics should not be kept at all. . . .

A consideration of service conditions will show that the speed and weight of trains for a considerable portion of freight service are quite as much under the influence of competition as in passenger service. . . .

Work Train Service.—There is no difficulty in determining quite closely the amount of ton-mileage that should be credited work train locomotives, as the weight of the train can be obtained as readily as that of freight trains and the mileage can be very accurately approximated. There appears no valid reason why statistics of work train locomotives should not be on the ton-mile basis, and its greater accuracy commends its use.

Switching Service.—Under present practice all locomotives used in switching service, regardless of size and power, are given the same credit. This is manifestly unjust, and it makes it practically impossible to closely judge of their efficiency. It would be much better to establish a standard switch locomotive tractive power, to which a certain credit would be given, making the credit of switch locomotives in proportion to their tractive power. For example: If the standard tractive power is made 15,000 lbs., and the credit for this standard is 3,000 ton-miles per hour, the credit for a switch locomotive having a tractive power of 20,000 lbs. would be 4,000 ton-miles per hour. . . . In view of the considerable expense due to switching locomotives, it would seem worth while to make special efforts to arrive at a just credit for their work.

What Tonnage Should be Included in Computing Ton-Mileage?— . . . Inasmuch as the ton-mileage of the locomotives is a very considerable item on a large number of roads, and it costs at least as much to produce a locomotive ton-mile as a car ton-mile, as it will work no hardship to roads on which the locomotive ton-mileage is a comparatively small part of the total, to include this item, and as the proper basis by which to judge the efficiency of the motive power department is not that of revenue or operating results, but the cost per unit of work performed, it seems eminently just that this department should receive credit for all the work done by it, which will include the ton-mileage of the entire train.

Pusher and Double-heading Service.—The ton-mileage of trains where pusher and double-heading locomotives are used evidently should be divided among the locomotives attached to these trains, and for the distance over which the helping locomotives are used, in proportion to their tractive power. . . .

Grouping Statistics.—While the influence of speed on the cost of locomotive service is considerable, and it may be possible to include it in our statistics, it is very probable it will be considered impracticable because of the expense and delay involved. In lieu of this it will materially increase the usefulness of ton-mile statistics if the various classes of locomotive service are grouped, so that the variations in speed included in each group will be very much less than though the statistics of all classes were thrown together. The groups which naturally suggest themselves are passenger, freight, pusher, work train and switching services, and the first two groups naturally divide themselves into fast and local. . . . In order that divisions and systems which have considerable branch line mileage may be fairly judged, it seems quite evident there will be a decided advantage in keeping the statistics of the main line and the branches apart.

Should an Arbitrary Weight be Added to the Weight of Empty and Partly Loaded Cars?—The fact has been established, beyond successful contradiction, that there is no constant relation between the weight of a car and the power required to haul it, but that a ton of empty cars requires more power to haul it than a ton of partly loaded cars, and this requires more power than a ton of fully loaded cars; also that the greater the capacity of a car the less the power per ton required to handle it when fully loaded.

The ideal system of tonnage ratings would be one which takes these facts into consideration, and would measure accurately the resistance a train will develop, regardless of the number of cars, load, empties or partly loaded cars it contains or their weight or capacity, as it is the resistance a locomotive is capable of overcoming which a tonnage rating should measure, rather than the number of cars or tons it is capable of hauling. While it is true that a system of adjusted tonnage ratings which endeavor to measure resistance instead of weight produces more efficient operating results, it is still a question whether it will be wise to determine motive power efficiency on the basis of resistance overcome or of weight moved. There are several matters which should be considered before arriving at a decision. In the first place it would be necessary to decide what system of "adjusted" or "equivalent" tonnage ratings should be adopted, and it is doubtful if sufficient experience has been had, or theoretical considerations could at present permanently decide, which is the best. In the second place, the arbitrary addition to the actual weight of the train would have to be different for almost every division of every railroad system, because the object of the modified systems of tonnage rating is to measure train resistance, and this varies with the grade and speed.

Theoretical considerations show, and careful tests have proven, that the resistance of a ton of empty cars compared with that of a ton of fully loaded cars, decreases with an increase of grade and increases as the speed increases. Again, that the adjusted tonnage should continue to be a just basis for ton-mileage, it will be necessary to change the factors from time to time, as the capacity of the cars increase, because the resistance per ton of train decreases as the capacity of the cars comprising it increase, and car capacity is constantly increasing.

In view of the facts presented it seems best to use the actual rather than the adjusted tonnage for motive power statistics, until a practical method of determining the actual horse-power developed by locomotives, or a single system of adjusted tonnage ratings has been devised, satisfactorily tested and adopted. This conclusion, however, is intended to apply only to such statistics as are to be used for comparison with other roads. Several systems have found from experience that the use of a system of adjusted tonnage ratings has resulted in increasing somewhat the ton-mileage of their locomotives, the uniformity of their trainloads, and shortening the time of trains between terminals. Keeping in mind that the correct unit for motive power statistics is that which most closely measures the work performed, and that this is true of the ton-mileage obtained by using the adjusted tonnage, it follows that the adjusted rather than the actual tonnage should be used. It has been urged that the adjusted tonnage should not be used in compiling motive power ton-mileage, because it is always greater than the actual tonnage, and would give a false impression of the business done. This argument overlooks the fact that the motive power department can not be fairly judged on the basis of revenue, as it has no control of it, but on the basis of cost per unit of work done. It is entirely practicable to judge revenue on the basis of actual tonnage handled and the motive power and operating results on the basis of adjusted tonnage all at a nominal expense.

The Best Basis for Operating Statistics.—The basis should be such that the resulting statistics will furnish not only a correct measure of present efficiency, but show and measure the effects of money spent for reducing costs. Until quite recently the almost universal bases of operating statistics has been the number of cars per train, cost per car-mile, or cost per train-mile. If money is spent in reducing the grade it will result in increasing the number of cars per train, a better showing on that

basis and a reduced cost per car-mile, but it will not materially change the cost per train-mile, because it is safe to assume the locomotives would be loaded to their capacity both before and after the grade reduction. It is evident that the cost per train-mile is not as good a basis for operating statistics as the cars per train or cost per car-mile, as it shows no advantageous results of money spent in reducing grades. . . . It appears evident that the bases of cost per train-mile and cost per car-mile are certain to lead to false conclusions. If the ton-mile, either as ton-miles per locomotive or cost per ton-mile is used as a basis for operating statistics, it will show the benefits of grade reduction, more powerful locomotives and larger capacity cars, both in increased ton-mileage per locomotive and reduced cost per ton-mile. . . .

Acting under authority given it at the convention of 1901, your committee corresponded with the American Railway Association and the American Railway Accounting Officers, and learns that while both of these associations have committees on mileage statistics at work, nothing definite has been decided upon as regards ton-mile statistics, and it is the belief of your committee that any action taken by this Association at this time would receive the careful consideration of the above associations. The statistician of the Interstate Commerce Commission also expressed interest and promise of co-operation.

The committee closes its report by giving a statement of the resolutions which it proposes to submit to the American Railway Association. These resolutions are the same as those passed by the 1901 convention with such changes as are made necessary by the adoption of the present report.

The report is signed by H. J. Small (Chairman), C. H. Quereau, G. R. Henderson, Geo. L. Fowler.

UP-TO-DATE ROUNDHOUSES.

The subject as a whole is so great and there are so many points involved in it that the committee has deemed it wise to divide up the work. The division is as follows:

The chairman of the committee, Mr. Quayle: To describe and discuss plans of terminals recently constructed.

Mr. Van Alstine: To present his ideas of an ideal plan covering and including all the desirable features.

Mr. Basford: To consider the details of terminals, including the details of recent construction.

Mr. Lang has been assigned the subject of operation of locomotive terminals, including sanding and coaling facilities, and the registering of engines in and out of terminals.

Plans of Terminals Recently Constructed.—I submit for your consideration, first: Fig. 1, which is a plan of roundhouse terminals at Clinton, Iowa, on the Chicago & North Western. This is flexible, and one, two, three, four or more roundhouses may be set in line. This part of the road points east and west, and it is the opinion of the writer that the roundhouses ought to be set parallel with the tracks. I have designated several of the tracks by letters, so that reference to them may be better understood.

At Clinton, Iowa, two divisions terminate. The Galena Division, 138 miles, and the Iowa Division, 202 miles. These are the lengths of both passenger and freight divisions. At a busy terminal, where there are from 200 to 350 locomotives a day to be handled, it is very necessary that engines should have track facilities that will enable the locomotive to be moved from the roundhouse up into the freight yard to be coupled on to its train without any interruption by the opposing movement of locomotives. It is also necessary to have an additional track that will enable the locomotive to come from the freight yard up and into the engine-house without being detained by opposing engines. This not only holds true for freight locomotives, but also for passenger locomotives. In Fig. 1, I will first consider the movement of passenger locomotives from the passenger depot, because on some roads they use a better quality of coal for their important passenger engines than they do on their freight engines; consequently they have the coal better taken care of, broken up and placed on the tender in better condition, and for this reason it is necessary to have one side of the coalhouse given over to passenger coal, and hence it is necessary to have a track on the side of the coalhouse over which the passenger coal is to be delivered to locomotives set aside for passenger locomotives, and on this plan the westbound track, marked "A," is known as the track for the movement of passenger locomotives. The depot being to the east of the roundhouse, the engines cut off from their trains and come up through the yard westbound until they enter upon track "A," on which they pass up to the coal chute and take coal, and immediately at the west end of the coal chutes is the sand tower, from which they take sand. They then pass on down to the standpipe and take water, and then move to the switch which gives them a clear way over their cinder-pits and into their respective roundhouse they go down to the eastbound track and engines.

If a passenger locomotive, leaving the house and going up to the depot to be ready to couple on to train after its arrival, is in the west roundhouse, which belongs to the Iowa Division, it will pass out of the roundhouse on the track to the east of the roundhouse, and will pass over what is termed the ash-pan pit, and if the ash-pan needs cleaning it will be cleaned out and the engine will pass onward down toward the depot, connecting with track "A," where they have access to a standpipe and can fill their tanks with water at that point, if necessary. When passenger engines go out from the east roundhouse they go down to the eastbound track and take water at the same penstock, and on east-ward to the depot.

Now follow the freight engines from the point of giving up their freight trains to their arrival in engine-house. The freight yard in this plan is to the west of the roundhouse and all east and westbound trains terminate in the same freight yard. As it is located west of the roundhouse they all have to come eastward past the coal chute on track "B," and then cross over to coaling track "C," where they will take coal and pass westward to the switch, and go into east or west engine-house in the same manner as described above for passenger engines. The freight engines will come out of each of the east and west houses in the same manner as shown above for passenger locomotives, except that instead of going up to the passenger depot they will only go to the first switch and then head up on track "A," and if there are no passenger engines to detain them on the coalhouse track "A," they will pass on said track up into the freight

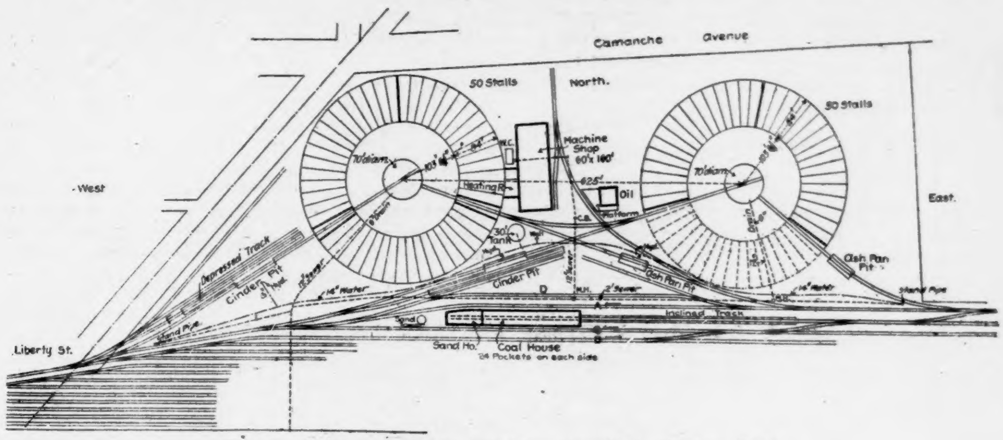


Fig. 1.—Chicago & North Western Terminal, Clinton, Iowa.

yard. But should there be passenger engines taking coal at the coalhouse on track "A," they will take track "D," called the run-around track.

This plan could be extended indefinitely so far as relates to number of roundhouses. It calls for a depressed track, of which the writer is in favor, as his experience during some severe winter weather has caused him to discount very materially the use of pneumatic hoists for such purposes. I would recommend that pits be long enough to clinker at least two engines at a time.

Fig. 2 is a plan of the McKee's Rocks yard, on the Pittsburgh & Lake Erie. This, for the lay of the land, makes a very desirable plan, and is a good deal the same as the Clinton plans, except that the positions of the

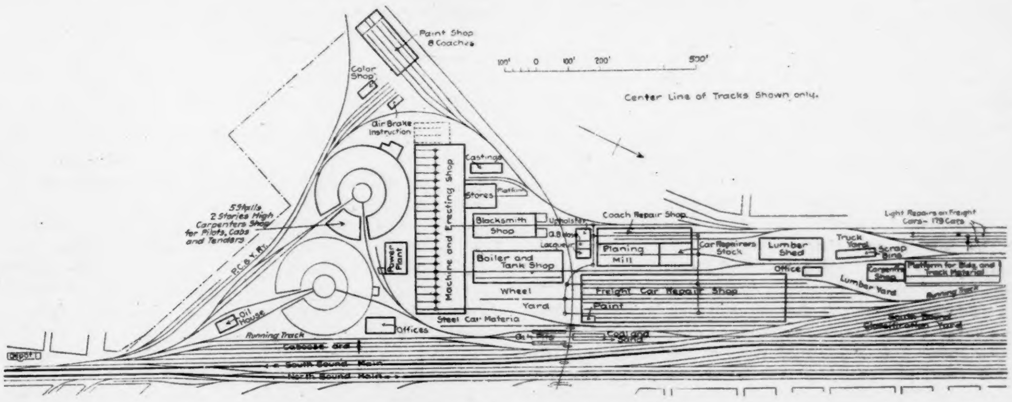


Fig. 2.—Pittsburgh & Lake Erie Terminal, McKee's Rocks, Pa.

roundhouses are reversed. In other words, the centers of these roundhouses are almost at right angles with the tracks.

The writer is of the opinion that ash-pits should be as close to the roundhouse as possible, particularly in the northern climate, for the reason that when an engine has to run 600, 700, 800 or 1,000 ft. before it gets into the house, the cold air that passes up through the fire-box, even though the dampers may be closed, is sufficient to cause the flues to leak, and this should be avoided wherever practicable. I believe the arrangement of the roundhouse and terminals as shown on Fig 2 to be very excellent. There is one thing, I find in this house, as well as in the Clinton house, namely, the tracks are in line with each other across the turn-table, which is very desirable.

The next proposition is that of a single house, Fig. 3, which shows the arrangement of tracks, roundhouses and other facilities for terminal at Collinwood, Ohio, on the Lake Shore & Michigan Southern. This plan is very excellent and speaks for itself. I notice that there are two out-going tracks, as well as two in-coming tracks from the roundhouse. One can take his choice of having it this way or having one in-coming track with a long clinker-pit and one out-going track. I think that this general plan is most excellent and would afford, no doubt, the minimum of delay and the maximum of expediency.

Fig. 4 is a North Western single roundhouse, or small plant. This is only an 18-stall engine-house, but ample room has been left for the extension to a complete circle. Fond du Lac, Wis., being a terminal point, the engines come in from different directions, and on this plan we have shown (which is in actual practice) a track leading from the north yard up into the engine-house over which the engine passes and thence on to a clinker pit 150 ft. in length. After the engine is clinkered, it passes down on the same track, taking sand and water as it goes into the house. The trains that come in to the south-end yard pass up toward the roundhouse and get the engines clinkered and take water and sand in the same manner. When the business at this plant will be large enough to justify handling more engines, it will require two out-going tracks, one in either direction.

The Ideal Roundhouse.—The ideal roundhouse, Fig. 5, is the one which handles engines with the least possible delay at the lowest possible cost. It provides in-bound tracks of sufficient length to store a large number of engines, on which are located coal chutes, sandhouse and cinder-pits. The coal chutes consist of 40 or 50-ton pockets on scales, into which hopper-bottom cars may be unloaded. The track above the pockets is reached by a 4 or 5 per cent. grade. At one end of the coal chute are the sand pockets, which are filled from cars same as the coal pockets. After the sand is dried it is stored in elevated pockets, from which it is drawn into sand boxes.

The cinder-pits are 150 ft. long and depressed tracks about 8 ft. below bottom of cinder-pits to allow of cheap loading of cinders into cinder cars. There should also be short cinder-pits in out-bound tracks for cleaning ash-pans of out-bound engines, and cleaning fires of switch engines. Stand pipes should furnish water to engines on in-bound and out-bound tracks.

The turn-table is 70 ft. long and operated by power.

The roundhouse is 80 ft. long in the clear, with doors 12 ft. wide and 16 ft. high.

It is heated by hot air from heater and fan, which passes around the house through an underground duct on the inside circle, and is distributed to pits through underground pipes. The air to be heated is not taken from inside the roundhouse. A hot well into which is drained all the exhaust steam from the plant as well as steam blown off from engines furnishes hot water for washing out and filling up, and for stationary boilers. The power-house boilers are arranged to burn front-end sparks where the price of coal makes it profitable.

The engine-room is provided with engine, dynamos, washout pumps, fire pump and air compressors.

The machine shop is provided with lathes, bolt cutter, drill press, shaper, grindstone, planer, screw press, blacksmith forge and anvil.

The storeroom contains all necessary supplies, except oil, and a tool-room for small tools.

The engineer's room is located close to the roundhouse foreman's office and contains bulletin boards and desk.

The roundhouse foreman's office is centrally located.

The lavatory is provided with wash basins, shower baths, closets and lockers for engineers, firemen and roundhouse men.

The oilhouse should be conveniently located for taking oil cans to and from engines.

In the roundhouse are tool racks between pits for pinch bars, wrenches and heavy tools, work benches on outer wall supported by brackets, drop pits for engine truck and driving wheels. An overhead track for lifting smokestacks, smoke-box fronts, steam pipes, steam chests, pistons, cylinder heads, cross-heads, etc., electric lights, electric and air motors for cylinder boring, etc. The overhead track has trolleys and chain hoists. The drop-pits have hydraulic jacks on carriages for raising, lowering and moving wheels. The rod man is provided with a work bench on wheels. A wheel storage yard is conveniently located for getting wheels into and out of the roundhouse. If fuel oil is used for fire kindling, a 6,000 gal. storage tank underground is located so that it can be filled from a tank car, and oil easily pumped from it for use in the roundhouse.

Recent Roundhouses and Details of Construction.—The Collinwood roundhouse of the Lake Shore & Michigan Southern is a good example of modern conditions and equipment, put into service the past year. Its equipment includes a shop, a storehouse, oilhouse, locker-room, as well as coal, ash and sand handling facilities. Notwithstanding the close proximity of the largest repair shops on the road, the locomotive terminal was made complete in itself, in order to facilitate in every way prompt and efficient work on locomotives, to reduce to a minimum the delays and time out of service for running repairs, and other necessary work upon them. This house has an inclined wooden roof, with ventilators in the roof and two intermediate posts for roof supports. It is heated by a fan.

The Canadian Pacific fireproof roundhouse has an inclined roof and is built of 18-in. I-beams, with two intermediate supports of 10-in. I-beams. The pits have 12-in. walls if of brick and 18-in. walls if of stone. On this road stone is preferred. This house cost about $1,650 per stall, exclusive of heating appliances and smoke-jacks, against about $1,300 per stall for the former standard, with brick walls and ordinary roofs. On this road steam pipes in the pits are used for heating.

The new Pittsburgh & Lake Erie roundhouse at McKee's Rocks has deep roof trusses and no posts. The heating is by a fan system, delivering into each pit from an underground duct. At the outer end of the section is a large ventilator, with generous openings. This roof truss gives 13 ft. 9 in. head room at the inner end. Another duct, or tunnel, at the outer wall, contains 4-in. blow-off and hot-water pipes. Steam and air are brought to each engine by 1½-in. pipes, carried on the roof trusses and dropping between the pits to a distance of 6 ft. 6 in. from the floor. With this form of roof the natural lighting should be excellent. The monitor has 4 ft. 6 in. by 8 ft. louvres, spread 5 ft. apart and sky-lights in the mansard. The house cost about $2,200 per stall, including everything except the heating equipment. It has rolling steel doors.

The standard No. 1 roundhouse of the Chicago & North Western, as constructed at Mason City, Iowa, has a brick outer wall, wooden posts at the doors, and wooden roof and supports. The roof is made in two portions, with the vertical skylight between. This house cost $1,845 per stall, complete, except the heating apparatus.

At Elizabethport, on the Central Railroad of New Jersey, a new roundhouse, with concrete walls, has just been put into service. It has concrete pits, an inclined wooden roof with three intermediate post supports. The heating is by a fan and underground duct.

At Du Bois, on the Buffalo, Rochester & Pittsburgh, a 16-stall roundhouse has just been opened. The roof trusses are of steel, with a slate roof.

In connection with the new Denver shop of the Colorado & Southern, a new roundhouse was completed last year. It has wooden smoke-jacks, a wooden roof with two intermediate supports, and a good arrangement for ventilation of the house. This house is heated by a fan system, with an underground duct, and beside the air duct is a subway for the piping. The roof construction costs about $60 per stall more than the ordinary flat roof.

At Nashville, Tenn., the Louisville & Nashville has installed a house. The intermediate supports of its roof, which is of wood, are extended to form the ventilator, which is 22 ft. wide, with slats in one side and ventilating windows on the other. The windows in the ventilator are valuable in increasing the natural lighting. This house cost $1,030 per stall, including the flooring, but exclusive of the pits and foundations. The pits and foundations cost approximately $400 additional, making $1,430 per stall, including foundations, pits and smoke-jacks.

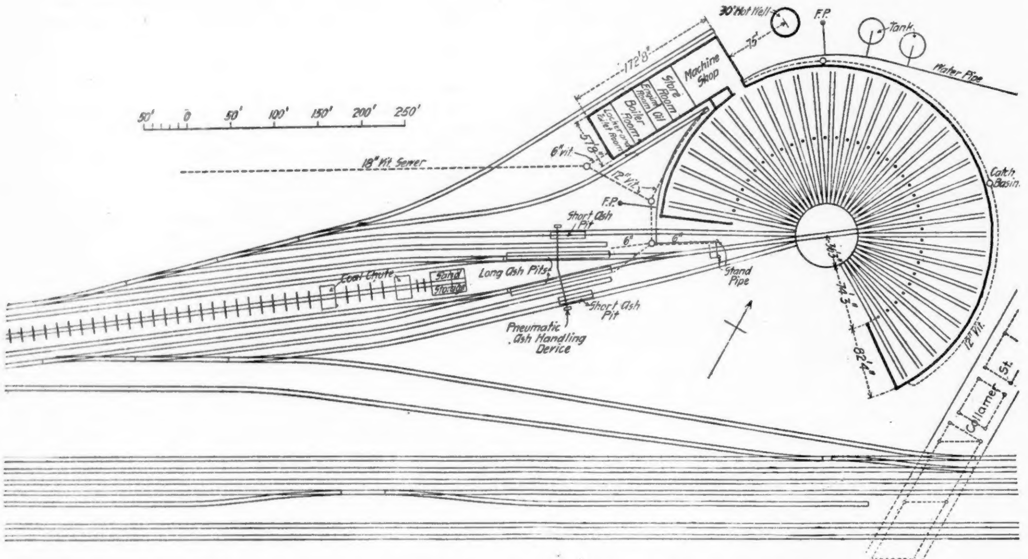


Fig. 3.—Lake Shore & Michigan Southern Terminal, Collinwood, Ohio.

Pits, Air Ducts, Pipe Tunnels.—There seems to be nothing new to offer in the construction of locomotive pits, except the concrete construction and an apparently satisfactory rail support used by the Lake Shore at Collinwood.

There is an apparent preference in connection with fan-heating systems for a distribution of the hot air from underground ducts instead of from overhead metallic conduits, chiefly because the overhead system takes up valuable room and obstructs the light. In one form of underground delivery the hot air passes into the ends of the pits. In another form the hot air duct is below the floor, but the delivery is directed toward eight points in each pit. By using removable elbows and dampers the hot air may be delivered against the machinery of the locomotive or against the trucks on the tender for the rapid melting of ice or snow. In this construction, devised by Mr. George Hill and used at the Elizabethport roundhouse of the Central Railroad of New Jersey, the entire heating system is out of the way and its construction is permanent. In addition to the pit outlets hot air is delivered into the roundhouse at each of the door posts.

Drop Pits.—Various plans for constructing drop-pits are indicated by engravings. In addition to the usual driving wheel drop-pits, special pits for truck wheels are usually provided, and on the Chicago, Milwaukee & St. Paul a large pit, 8 ft. 8 in. by 10 ft., sufficient to drop a complete engine truck, is put into each of the principal roundhouses. In many cases the pits merely provide for lowering and raising the wheels, but the best practice provides for lateral movement of the wheels when lowered, so that they may be removed from under an engine and raised to another track, for removal to the shop. Stationary jacks seem to be preferred. A drop-pit, of concrete construction of the New York Central is illustrated, which is used in all new roundhouses. This pit serves two tracks, and reaches toward a third track a sufficient distance to permit of removing wheels at the end. The drawing shows the pit used with roundhouses of 418 ft. diameter. In some cases drop-pits have been built with a curvature to a radius from the center of the turn-table. Those at Elizabethport of the Central Railroad of New Jersey and at Du Bois on the Buffalo, Rochester & Pittsburgh, are so built. The drop-pit at Elizabethport takes in three tracks, which is advantageous. That construction is believed to be the best which provides for lateral displacement of driving and truck wheels with the least expense in masonry construction.

Heating and Ventilation.—Nearly all large roundhouses of recent construction are equipped with fan systems, these being considered as furnishing the ideal method of heating. For small houses, steam pipes in the pits seem to be the most economical. In the plans accompanying this report are a number of different arrangements of conduits from the fans, most of them underground. The conduits may then be of brick and concrete and are permanent. When underground they are also entirely out of the way and do not obstruct the light. Various methods are employed to distribute the hot air to the pits, the chief point of interest being the methods of delivering the air under the engines and tenders for the purpose of quickly melting snow and ice. . . . The roundhouse pits of the Jersey Central at Elizabethport are fitted with elbows to direct the air to the machinery. These, when pushed into the bushings in the walls, automatically open the delivery dampers.

For good ventilation the volume of air required from the fan is much greater than is required to pass through the fan for heating alone. . . . In order to secure definite figures, one of the leading firms of engineers, making a specialty of heating and ventilation, was asked to submit suggestions based upon the roundhouse shown in Fig. 5 of this report, the conditions being those of the climate of Chicago, the minimum outside temperature being 20 deg. below zero, the inside temperature to be 70 deg., and the range of temperature of the hot air to be from 125 to 150 deg. This information is as follows:

Number of stalls	42
Approximate cubical contents per stall	34,700 cu. ft.
Air supply per stall per minute	2,000 cu. ft.
Total air supply	84,000 cu. ft.
Temperature air supply	140 deg. Fahr.
Size of fan	11 ft.
Speed of fan	150 r. p. m.
Size of engine	11 x 14 in.
Lineal feet in heater	8,500 to 9,500.

"These figures are subject to some change, depending, first, upon the character of the exposure, the probable minimum outside temperature, variable steam pressure, and the amount of hot air returned to the fan. You can readily see that unless we were given a specific case and knew all of the conditions pertaining thereto, it is quite impossible to figure closely.

"Assuming the cubical contents per stall about 34,000 cu. ft., and assuming the temperature of delivery 125 deg., a careful computation, taking into account only the heat loss from walls, roof and windows, and making no allowance for the opening of doors and other accidental ventilation, we find that it will be necessary to supply 1,200 cu. ft. of air per minute per stall to maintain an inside temperature of 70 deg., with an outside temperature minus 20 deg. In order, therefore, to safely provide for accidental ventilation, the air supply should not be less than 2,000 cu. ft. This will serve to show that an air supply of 800 cu. ft. would hardly be large enough unless there were unusually favorable conditions to be met."

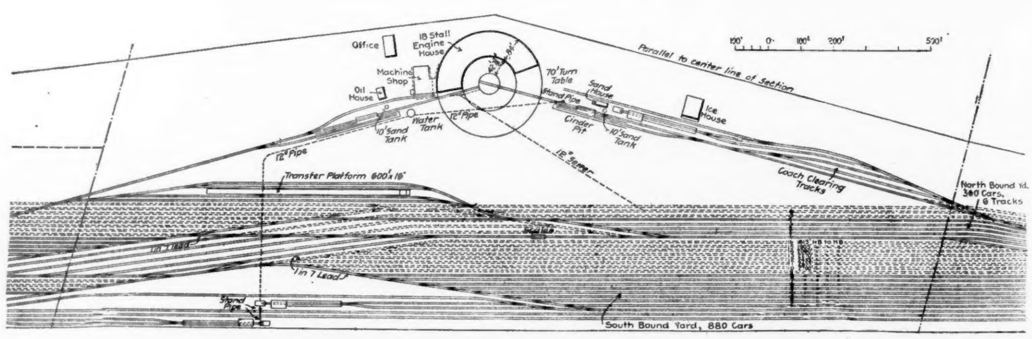


Fig. 4.—Chicago & North Western Terminal, Fond du Lac, Wis.

To secure the best conditions of ventilation and heating it seems wise to consult the leading firms dealing in this apparatus and provide a liberal appropriation for the equipment, and to secure a fan capacity far greater than sufficient to maintain a comfortable temperature at all times, then to drive this fan hard enough to secure good ventilation through the smoke-jacks and roof ventilators.

Smoke-Jacks.—Nothing new in smoke-jacks has come before the committee. Wooden jacks, fireproofed with paint and sand, appear to be growing in popularity. They do not corrode. Telescopic jacks continue in favor where they are used, also those of tile and those having swinging lower sections to accommodate slight displacements of the engines.

Blow-off and Washout Piping.—There seems to be a marked tendency toward putting all water and steam piping about roundhouses in conduits under ground. When exposed to gases the piping is apt to become leaky and this soon leads to great discomfort from the dripping of water and blowing of steam. Air and steam blow-off pipes are run overhead without serious inconvenience. Blowing down the steam and water from boilers usually requires a long time, and better facilities should be provided. If steam is blown down from the steam domes a large pipe and large connection should be provided or the process will be too slow. Ideal practice would blow

this steam off into a cistern to heat water for washing out. This is done at Collinwood. The water from the blow-off cocks is often run off into the roundhouse pits and allowed to pass into the drain. At West Milwaukee, on the C. M. & St. P., the ash-pits and roundhouse-pits are piped for flexible joint connections to the blow-off cocks and the water disposed of to the drains, without filling the air with steam. This is an excellent plan, but there seems to be no objection to piping this water to the cistern for use again in washing out boilers. The P. & L. E. roundhouse at McKee's Rocks has 10 pits set apart for boiler washing. These are piped to the sewer to avoid the escape of steam. There seems to be need of improvement in methods of washing out boilers. It should not require four hours to do this work, and yet this is quick time under average conditions.

Lighting.—For lighting the interior of a large roundhouse one large arc lamp at each pit, about 15 ft. from the floor and about 25 ft. back from the front-end of the engine seems to answer very well. Incandescent lamps, three between each two pits, with additional portable lamps for attachment to plugs at the posts, seem to serve equally well.

Floors.—A good floor, adopted by the New York Central for roundhouses, is prepared as follows: Upon a leveled sub-grade an 8-in. bed of cinders is placed and thoroughly rammed. Upon this is placed a 5-in. layer of concrete, consisting of one part of Portland cement, four parts sand, and seven and one-half parts of broken stone. Upon this is a top dressing, 1 in. thick, composed of one part Portland cement and one part of sand. This is deposited simultaneously with the concrete to insure a perfect bond. The top is surfaced true with long, straight edges, and is floated to be smooth. Drainage is secured by raising the floor to a height of 2 in. above the rails, midway between the pits. This floor has been used for seven years by the New York Central with satisfactory results. It has no lodging places for water, dirt or grease, and is easily kept clean. It is also easily repaired. A good floor is also made by setting vitrified brick on edge in tar. Care should always be taken to secure perfect drainage and maintain a dry floor.

Coal, Sand and Ash-Handling Facilities.—Coaling plants for locomotives have been described in the proceedings of this Association, but it seems advisable to include recent improvements in connection with the subject of the roundhouse. In a recent installation on the Santa Fe at Lorenzo, Ill., cars are hauled up the incline by a wire rope by means of a hoisting drum, which is driven by a 30-h.p. Otto gasoline engine. One man operates the machinery, which has a capacity of 150,000 lbs. gross weight on a 20 per cent. incline at 20 ft. per minute. From the car the coal is delivered to the tender by gravity. At the top of the incline the grade is 1 per cent., sufficient to start the cars at any time. Cables 600 ft. long are used in these plants. This is enough to permit of switching eight or ten cars with the hoisting apparatus, a switch being provided at the bottom of the incline for this purpose. The band-brake on the friction drum used in lowering the cars and the friction clutch is to hold a car at any desired point on the incline. The hand-wheel controls the band-brake, and it is easily operated. This brake seems to be a vital feature in the success of this hoisting arrangement.

Another plan, which has been extensively introduced on the Chicago & Alton,* combines coal, ash and sand handling facilities in one plant. This design was developed and is manufactured by the Link-Belt Machinery Company, of Chicago. Among the details of this construction is an undercutting valve in the delivery chute, which cannot become clogged by lumps of coal. It is intended that the entire plant shall be handled by one man. Similar facilities have been supplied to other roads.

Sanding Plants.—Where the demand for sand is large, as on roads with a concentration of a large number of engines in a small territory, it seems advisable to install central sand drying outfits and distribute the dry sand in box cars.

At Middletown, N. Y., the New York, Ontario & Western has a sandhouse of brick, 25 by 46 ft. in size. Sand is received in gondola cars and shoveled through one of the windows. From the dryer it falls into a hopper and passes into a sand reservoir, from which it is elevated by compressed air into the dry storage for delivery to the engine on the tracks outside of the building. Other tracks may be reached from the storage bin if desired.

At Collinwood, on the Lake Shore, sand is received over the coal-chute trestle, at the end of which it is dropped from the car into a storage bin. It is shoveled into a steam dryer and falls into either of two sunken reservoirs. From these it is elevated through straight vertical pipes into the dry storage above, and is ready for the engines. On applying air pressure to sunken reservoirs the air first passes through a vertical cylinder and raises the piston of the cylinder and closes the entrance from the dryer by means of a large rubber ball. When this ball-valve is closed the piston is high enough to uncover the opening to a pipe which admits the air to the reservoir and elevates the sand.

In a rotary sand dryer used on the Chicago, Milwaukee & St. Paul at West Milwaukee, the sand used is very wet, and with it the machine has a capacity of 10 cu. yds. in 12 hours. This dryer is of boiler plate; it is inclined and screens the sand at the lower end. It is rotated by power, and when automatic conveyors are installed to deliver the green sand its capacity will be increased somewhat, and the labor cost of operating will be reduced one-half. The dryer has two grates. An improvement has been introduced on the Chicago & Alton, whereby the drying of sand is facilitated by the use of a perforated pipe to take away the moisture.

Ash-Pits and Hoists.—Ash hoists are used in many forms for raising ashes from the ash-pits. Compressed air is generally used to raise buckets from the pits. The ash-pit is supplied with a number of clam-shell buckets, resting in cradles, with wheels to run on the pit rails beneath the engines. The hoist dumps these buckets into a car on the adjacent tracks. One large road is preparing to install an electric traveling crane over its ash-pits, believing that this will be the most satisfactory device which can be used for this purpose.

The depressed-track ash-pit has not been altogether superseded by power devices, and is believed by many to be cheaper and more satisfactory than more elaborate equipment. Local conditions, however, do not always permit its use. When these tracks are used the pits should be of ample length, and the depressed track should be low enough to bring the top of the cinder car to the level of the ash-pit rail, and the side of the car should be very close to the rail. It requires rather careful study of conditions to determine the point where the advantage of power ash-hoisting devices begins. This depends upon the number of engines and the available time of men who must be on hand for other purposes.

Water Cranes.—The most notable improvements in water service seem to be those on the Chicago & Alton, the new cranes being unusually flexible, and have a 15-ft. spout. When locomotives stop on the single track in either direction to take coal the tender must be opposite the center of the coal spout of the adjacent coaling station. This would bring the manhole of most tenders about 12 ft. to the right or left of the water spout. With the long water spout the manhole may be reached in either case without moving the engine. This long spout is used only for single-track stations, requiring the engine to make an exact stop at the same place in either direction for coal. This water crane delivers water at the rate of from 4,000 to 6,000 gal. in one minute, depending upon the length, directness and diameter of the pipe. While this seems, perhaps, unnecessarily large capacity for roundhouse service, it seems desirable to point out the importance of every time-saving facility at roundhouses as a money-saving investment. Standard water-crane apparatus is now being furnished which will supply 6,500 gal. per minute. The Chicago & Alton and Chicago & North Western roads are leading in the installation of this equipment. Nearly all of the standpipes recently put in on these roads are 12 in. in diameter.

Roundhouse Shops.—Irrespective of shop facilities for repairing locomotives, roundhouse equipment must now be kept up to a high degree of efficiency in order to reduce to the minimum the loss of time in doing the necessary work at terminals. In the present state of business the roundhouse must be near a shop, or it must have shop facilities in its own equipment.

The new Lake Shore roundhouse has a convenient shop, with the following tool equipment: A 26-in. triple-geared shaper; 36-in. by 36 in. by 12 ft. planer; 18-in. engine lathe, with 5-ft. bed; 30-in. drill press; 24-in. engine lathe; a sensitive drill; a single Acme bolt-cutter; double-arbor emery-grinder; blacksmith's forge; pipe-bending blocks and two screw presses. The Chicago & North Western roundhouses have small special shops adjoining, and so also have the new roundhouses on the New York Central.

Power-Driven Turn-Tables.—Locomotives have become so heavy, and the demand for quick roundhouse service so urgent, as to necessitate power-driving for turntables, where many locomotives are handled. The choice of power depends upon circumstances. Electric motors are most satisfactory when power is available both night and day, and electric equipment is the simplest and most cheaply maintained. When an independent equipment is necessary, the gasoline engine offers peculiar advantages. It is the cheapest to install and is reported to be satisfactory. Compressed air and steam are also satisfactory and convenient. In cost of operation electric motors and gasoline engines are about the same, the expense for turning 250 engines every 24 hours being about $4, including repairs, gasoline or electric current. The cost of installation of a motor equipment is about $1,400. That of a gasoline engine is about $1,000, and that of a steam engine $1,200.

The Operation of Locomotive Terminals.—This report gives the average practice in roundhouse organization, stating the duties of foreman and assistants. The desirability of reporting all breakages of engine parts to the Mechanical Engineer of the road by the foreman with his opinion of the cause of breakage is urged, and the practice of some of the larger roads of having forms giving the outlines of parts in order that breakages may be indicated thereon is mentioned. The plan generally followed in handling engines at roundhouse terminals is then given, from the time it is left on the incoming track by the engine crew, the engine man having inspected it in order to report on its condition, to the time of its again being delivered by a despatcher and helper to the outgoing crew. Referring to the practice of engine crews registering out, the report says:

Some roads require the engine crews to register out, some to sign a call book when called for the run, and others do not require the crew to register at all, but take their record from the bulletin-board in the roundhouse.

The work slips are handled in numerous ways. It may be said that in general the slips are handed out to the workmen who are to do the work, and in case two or more men are required to do as many classes of work, such as machinists, boilermakers or handymen, duplicate slips are drawn off by the foreman or assistant and given to each man, who, on the completion of work assigned to him, checks off his part and signs his name on the back of slip and returns to foreman or assistant, who is thus advised of the completion of the work. A very good plan, which materially reduces the work of the foreman or assistant in drawing off these duplicate slips, consists in having the engineer's work-report books printed on manifold or carbonized paper. The engineer is then enabled, with but one writing, to make as many copies of his report as will be necessary to distribute to the men who have to do the work. On one of the large railroad systems in this country a clerk is provided at each roundhouse, whose duty it is to make out these reports for the engineer. Another plan is to provide a work book in which engineers write their work reports, and from which the foreman or assistant assigns the work, by marking the initials of the workmen to whom it is assigned opposite to same, and in which workmen check off and sign for that portion of the work they have done. The former method would seem the more desirable, in that the men are not required to go constantly to the work book to see what is assigned to them, and again to check it off, which necessarily consumes a great deal of time. The former method requires more running about for the foreman or assistant, to keep the men employed, but it keeps the foreman in touch with the progress of the work, which is certainly desirable. The work slips are filed in pockets provided for each engine, and are usually tied up in bundles at the expiration of six months for future reference.

At times the movement of engines through a roundhouse terminal may be slower than the Master Mechanic thinks necessary. At such places a blank calling for the time of arrival of engine at coal-chute track, cinder-pit, turn-table and time of leaving roundhouse, with such other information as may be desired, may be filled in for each 24 hours by the foreman, and sent daily to the

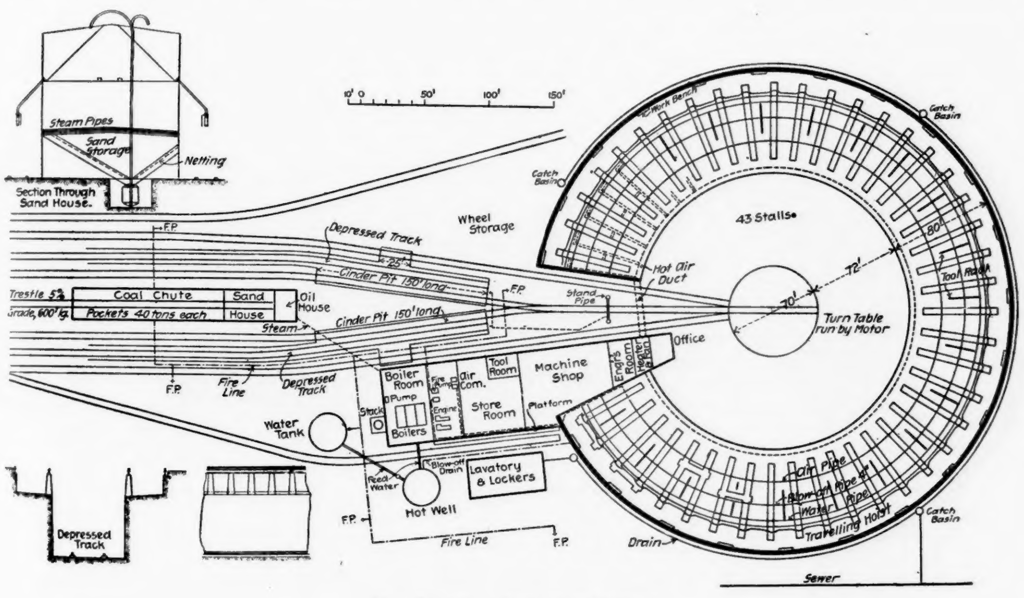


Fig. 5.—The Ideal Roundhouse.

* Illustrated and described in the *Railroad Gazette*, March 14.

Master Mechanic. This to continue for a week or so, or until an improvement is seen.

At the largest division points, such as the C., M. & St. P. terminal at West Milwaukee, where seven divisions center at one roundhouse, and where there are about 800 engineers and firemen running in and out, it is something of a task to keep track of all the men. An illustration of the bulletin-board prepared for this purpose is shown in Fig. 6. Also an illustration showing the tags to be used in connection with same, which is shown in Fig. 7. The use of the board may be explained as follows: Tag No. 1, if hung in black column or under

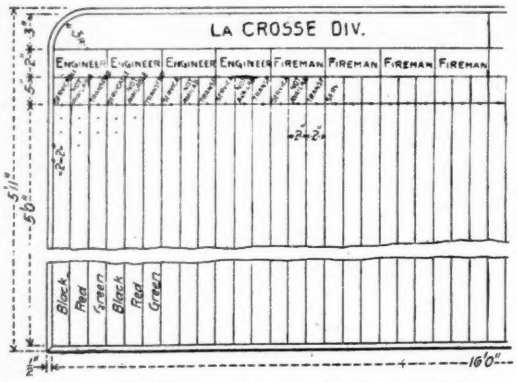


Fig. 6.—Roundhouse Bulletin Board, West Milwaukee.

Fig. 7.—Tags for Bulletin Board.

the head of "Serviceable," would indicate that John White, living at 1001 Thirty-first street, was a serviceable man. In case of Tag No. 2, it would still hang in black column or under the head of "Serviceable," but would indicate that John White had asked for a rest until 3 p.m. In the case of Tag No. 3, it would hang in the green column under head of "Transferred," and would indicate that John White, for the time being, was temporarily in service on another division. Tag No. 4 would be hung in the red or "not available" column, and would indicate that John White was sick, and had been since the date shown on the card; or, if given a leave of absence, his tag would indicate the date to which his leave of absence was extended. If suspended for any cause his card would also hang in the red column, and indicate the date to which he was suspended. A supply of small cards to be inserted in Tag No. 2 is to be kept on hand near the bulletin-board, showing hours in a.m. and p.m., so that when a man calls for rest the person in charge of the board can, without making a check, immediately provide a card showing the hour to which the rest period extends. The small card is inserted in front of the regular tag.

Another method consists of small blocks being used, on the edge of which are printed the names of the engineers and firemen. The edges are also colored to show if the man be passenger, freight or switch engineer or

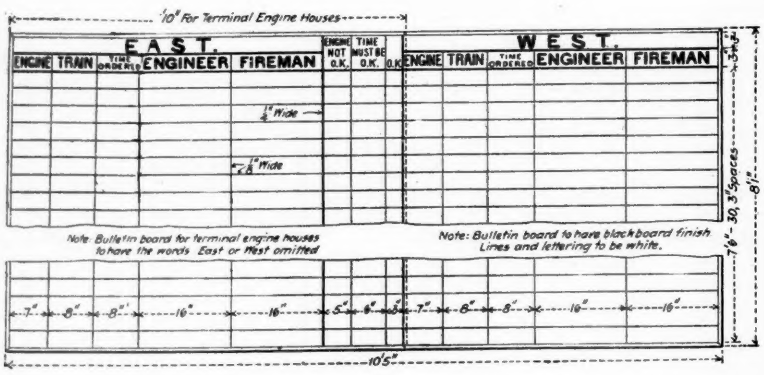


Fig. 8.—Roundhouse Bulletin Board Where Two Divisions Meet.

fireman. These blocks are moved about in cases provided for them, and require very much less space than the bulletin-board described above, and give practically the same results.

Fig. 8 shows a very good example of a bulletin-board for a point where two divisions meet. A column showing the number of the stall in which the engine may be found is an excellent addition to a board of this kind, and will be found very useful in the location of an engine in the house. The despatcher should mark up the stall number opposite the engine number at once after placing engine in the house.

This report is signed by Robert Quayle (Chairman), D. Van Alstine, V. B. Lang and G. M. Basford.

IMPROVEMENTS IN BOILER DESIGN AND BEST PROPORTIONS OF HEATING AND GRATE SURFACES.

It was decided to deal with that portion of the subject that concerns heating and grate surface. The remaining portion, dealing with improvements in design, is of sufficient magnitude to form an independent paper. As such a paper would be valuable, the committee recommends that it be considered as a subject for the next convention and a new committee appointed to investigate and report on it.

Knowing from past experience that it is difficult to obtain from the members full and prompt replies to a circular of inquiry, the data for this paper was obtained from the technical press. It consists of the engines illustrated by the different railroad papers during the years 1900, 1901 and the first four months of 1902. As only new types of engines, representing the most advanced ideas of buyer and builder, are so treated, it will be seen that the data is reliable, full and covers the most recent practice. In addition to the engines obtained in this manner, a few engines with boilers and fire-boxes for burning anthracite coal, the performances of which are known by the committee, have been added. . . . As the boiler must furnish a certain amount of power, or an amount of energy sufficient to perform a certain amount of work in a given time, it becomes apparent at once that the real basis from which the amount of heating surface should be computed is the maximum power, and that the total heating surface of any boiler is the product of a constant times the maximum power demanded by the service. If we take for the unit of power, a horse-power, the formula for heating surface becomes of the following form:

Total heating surface = (constant) × maximum horse-power.

The English rule for the maximum sustained speed of an engine is:

10 × diameter of drivers (in feet) = MPH.

but for the sake of simplicity, if we take the maximum sustained speed as equal to as many MPH. as there are inches in the diameter of the drivers, we have for the sustained speed

MPH. = D, and equation (2) [not reprinted—EDITOR] becomes:

$$\frac{Pm\ d^2\ S}{375} \qquad (3)$$

[Pm = mean effective pressure; d = diameter of cylinder; S = stroke.]

Where the MPH. equals the diameter of drivers in inches, the revolution per minute becomes constant, or RPM. = 336. The Baldwin Locomotive Works, in their handbook (page 27) show that for 336 revolutions per minute the mean effective pressure is 30 per cent. of the initial pressure, and the initial pressure about 76 per cent. of boiler pressure. This makes the mean effective pressure

$$Pm = .3 \times 76 \text{ (boiler pressure)}$$
$$= .228 \text{ or } 23 \text{ per cent. (boiler pressure) } (P).$$

Substituting this value for Pm in (3) we have:

$$\text{H.P.} = \frac{.23\ P\ d^2\ S}{375} = \frac{P\ d^2\ S}{1630} \qquad (4)$$

Where P = boiler pressure.

The above, while applying to simple engines, does not apply to compounds, nor is there any available data to show the average mean effective pressure of a compound at high speeds. If, however, we equate the gross tractive power of a compound engine to the gross tractive power of a similar simple engine, and then solve for cylinder diameter, we have the size of a simple cylinder having the same power as the compound. This was done for the compound engines, and the size of the equivalent simple cylinders are shown on the data sheets. It is admitted that this method is open to criticism, yet as the results are to be used for comparative purposes, in the absence of more authentic information, it provides a basis for comparison and indicates limits which may be of service in future designing.

The important relations in boiler design are those between the power and total heating surface and between the total heating surface and grate area. These relations for the engines in question have been determined and have all been tabulated on the data sheets. The relations have in all cases been determined graphically.

Referring to Fig. 1, the maximum, mean and minimum ratios of total heating surface to maximum I.H.P. have been determined is follows: Using as ordinates the value of these two factors, a point was determined for each engine under consideration. A line drawn approximately through the middle of these points is an average or mean location of all points. If in the equation of a straight line, $y = ax \times b$, we substitute the ordinates of any point on the line, we have an equation where if one of the ordinates be known, the other can be determined. After locating the mean line, the extreme lines representing the maximum and minimum limits were drawn and their equations determined. In locating the limiting lines it has not seemed advisable where one point or engine comes some distance outside of the others, to allow it to have too great an influence in determining the location of the lines, so that the limiting lines are the limits of average practice. All ratios have been determined separately for

(*a*) Simple passenger engines.
(*b*) Compound passenger engines.
(*c*) Simple freight engines.
(*d*) Compound freight engines.

Where the ratios deal with grate areas, these divisions have been further subdivided so as to cover both anthracite and bituminous coal. The number of engines constituting the data from which the grate area proportions for anthracite coal were determined is small—in one case only three engines. Each engine, however, represents a class in which there are a large number of individual engines, and it is known that their performance is satisfactory.

Table I gives the ratios of total heating surface to

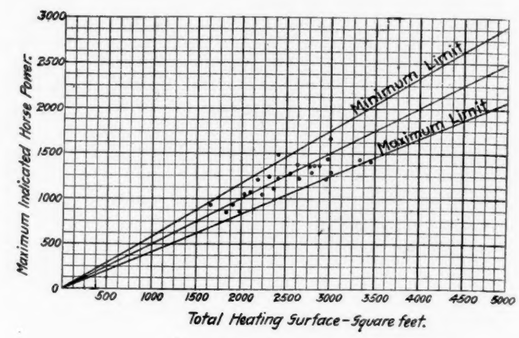


Fig. 1.

maximum indicated horse-power, or in other words, the square feet of heating surface per indicated horse-power.

Table I.

Kind of Engine..	Simple Passenger.	Compound Passenger.	Simple Freight.	Compound Freight.
Maximum ratio.....	2.39	2.58	2.30	2.15
Mean ratio..........	2.00	2.13	1.71	1.80
Minimum ratio......	1.72	1.70	1.48	1.58

The compound passenger engines show the greatest variation between extremes, and the compound freights the least, while the compound engines have in each service a higher mean ratio than the simple engines.

Table II gives the ratios of total heating surface to grate area, or the square feet of heating surface per square foot of grate area.

Table II.

Kind of fuel.	Bituminous Coal.				Anthracite Coal.			
Kind of engines.	Simple Pass.	Comp'd Pass.	Simple Freight.	Comp'd Freight.	Simple Pass.	Comp'd Pass.	Simple Freight.	Comp'd Freight.
Max. ratio.	90.50	94.50	87.00	87.50	40.38	35.38	37.38	45.63
Mean ratio.	66.67	75.00	71.50	66.67	33.50	32.75	31.63	39.25
Min. ratio..	51.50	62.91	47.00	51.25	27.75	23.63	27.88	30.63

In the above table, under bituminous coal, the ratios found cover grate areas for burning nearly all grades of this coal. The maximum ratio is probably only suitable for extremely free burning qualities, and should not be exceeded. The mean ratio is probably suitable for the average quality of bituminous fuel, while the minimum limit is suitable for the poorer qualities. While division is made between anthracite and bituminous coal on the diagrams and tables, in reality no such division exists, the maximum ratios under the latter head being suitable for slack bituminous coal, and in fact one lot of engines plotted under this head burns bituminous coal. The higher ratios under anthracite coal are really only suitable for low grades of bituminous coals or a mixture of ordinary bituminous coal with fine anthracite. The mean ratios are suitable for good lump anthracite, and mixtures of bituminous and fine anthracite, while the minimum ratios are none too small for ordinary lump anthracite, mixture of fine anthracite and bituminous, and fine anthracite alone.

Other diagrams in the report show the relations between power and weight, and are to a certain extent an index to the probable weight of a new engine after the power has been decided. These relations are given in Table III.

Table III.

Kind of Engine.	Simple Passenger.	Compound Passenger.	Simple Freight.	Compound Freight.
Max. ratio or weight in lbs. per I. H. P.	145.0	165.0	142.5	127.50
Mean ratio or weight in lbs. per I. H. P.	127.0	135.0	115.5	113.25
Min. ratio or weight in lbs. per I. H. P.	108.0	111.0	101.25	102.25

The committee, in connection with this report, recommends that the Association adopt as a standard:

(1) For comparisons of heating surface, the relation between the indicated horse-power and total heating surface, the formula for I.H.P being:

$$\text{I.H.P.} = \frac{P\ d^2\ S}{1630}$$

(2) For comparisons of weight, the relation between the indicated horse-power and the total weight of engine.

In case of the adoption of these methods by the Association it is further recommended that the Secretary of the Association be instructed to communicate with the

technical press and request their co-operation in the use of these methods of comparison.

The report is signed by Geo. W. West (Chairman), T. W. Demarest, H. D. Taylor, John Player.

STANDARD SPECIFICATIONS FOR DRIVING AND TRUCK AXLES.

When notified of the appointment the committee promptly organized for work, and in addition to sending out the usual circular, commenced a systematic canvass of the whole subject. A few replies to the circular were received, mostly of a very comprehensive and interesting character. The information gathered was duly tabulated and arranged for a final meeting of the committee to determine upon the report to be presented. In this connection the valuable work of the International Association for Testing Materials, in formulating Standard Specifications for Axles and Steel Forgings, was brought to the attention of the committee, and it was thought that the proposed specifications, as drawn up by the American Section of the International Association were in the main so comprehensive and satisfactory that, with slight modifications, they would be acceptable to the Association. On this account it was decided to report progress and to ask the Association to authorize the committee, and invest it with the necessary power to co-operate with the International Bureau of Tests, with a view of having such changes incorporated in the proposed specifications as would make them acceptable to the Association, and to report to the next regular meeting of the Association. The committee would also request that a representative from each of the locomotive companies be added to the committee. . . .

This report is signed by A. E. Mitchell (Chairman), Samuel Higgins, W. S. Morris and L. R. Pomeroy.

ELECTRIC DRIVING FOR SHOPS.*

The general principles governing this mode of transmission of power have been well covered by a committee report presented to this Association in 1900 and in recent papers in other associations, as well as in contemporaneous literature. The development of the art, however, shows such advances and new opportunities that I may not be amiss in feeling that this Association may be interested in knowing of what were the considerations and ruling factors in the design of one specific example and the application thereto of the principles laid down by your former committee, rather than in a repetition of a general paper on the subject. . . .

As an example of an old shop, very largely added to, employing auxiliary steam and power in several departments, I will name the Roanoke shops of the Norfolk & Western. (See *Railroad Gazette* June 20.) These shops were built in the early '80's, on a liberal scale, and fortunately were laid out so that additions consistent with the general plan could be made. By June, 1901, the work required at Roanoke had developed to an amount that important additional buildings were planned, necessitating also a general revision of the power transmission which should also check the waste due to the several plants. A liberal appropriation was made after plans and estimates were prepared, and these improvements have since been partially installed. . . .

The Roanoke shops take care of the medium and heavy repairs of nearly 500 locomotives, mainly of the consolidation type, build complete one 21 x 30-in. consolidation engine per month, and of cars about 1,000 per year. Add to this the freight repair work of 1,600 freight cars per month, the entire passenger equipment, heavy repairs and considerable building of new passenger equipment, miscellaneous road work, switches, water station and coal pier work, etc., of a 1,600-mile road. Include also a foundry whose record for 1901 was as follows: 950,000 lbs. of brass and phosphor-bronze castings, 44,000 lbs. of white metal, 5,385 tons of gray iron castings, and 43,000 car wheels.

The various power plants at these shops in June, 1901, were as follows:

Shop.	Boilers. Nom. Rating.	Engines. Nom. Rating.
Machine shop	270	200
Electric plant	...	170
Smith shop		
Smith shop aux	60	...
Smith shop aux. furnaces	90	...
Flue shop and blowers		
Bolt shop		
Toolroom		
Testroom		
Air compressor		
Erecting and boiler shop	90	30
Erecting and boiler shop	...	30
Air compresor		
Foundry	60	40
Pattern shop		
Planing mill	260	225
Air compressor		
Frog and switch shop	50	30
Rail sawmill	...	50
Dry kiln		

From this table it will be noted that there were two principal power plants, one in the machine shop which furnished power to a number of shops, and one in the planing mill whose boilers furnished steam for various purposes. Besides these, there were five auxiliary plants of boilers or engines, or both, making a sum total of 880 nominal horse-power of boilers and 775 nominal horse-power of engines for shop power, heating and lighting, the latter service extending beyond the shop's inclosure and furnishing all-night and such day lighting as was required for lighting general offices, hotel, depots and yards. Thus it will be seen that a varied, scattered power service had been built up, and to take its place a new plan must be made which should take into consideration the concentration so far as possible into a central power station such an amount of power as would do away with all auxiliaries, thereby securing economy of fuel, economy of handling of fuel and ashes, in operating force and expense for supplies and repairs. In this plant the change had to be made without interference with the operation of the shops or lighting plant. A careful study of the situation developed the following plan: To provide a new boiler plant capable of developing steam for all power needed save and except only such as could easily and with certainty be made by refuse from the planing mill with practically no extra cost of handling, the object being rather to utilize a means, without wasting it, of burning refuse.

In large electric installations the center of electrical distribution is an important point to find, and the generating plant should be placed near thereto. In shop plants this is not always the ruling factor and it may pay to use a little more copper and place the plant where other considerations are of more importance. In this case the utilization of a large brick stack of sufficient capacity and the location of an elevated trestle for directly dumping hopper cars of coal indicated the location of the new boilerhouse, which was planned for the immediate installation of 600 nominal h.p. of boilers and reserve for 400 h.p. additional. In a more northerly location additional boiler capacity would be needful in winter for an establishment of this size. These boilers are in 200 h.p. units, it being believed that smaller units do not give a like economy and that it would not be wise to have less than a two-thirds capacity to fall back on in case of the failure of any one boiler. . . .

The direct-current system of electric transmission of power and lighting was adopted, using two-wire, 220-volt current for motors and three-wire system for lights. This was determined upon after visiting a large number of plants. Instead of preparing a set of specifications requiring a definite arrangement of the electrical machinery, it was thought best to issue an invitation to the electrical companies to tender on such forms of apparatus as in their opinion would best suit our needs, these needs being fully set forth for their information. The instructions relative to the general layout reads as follows: "There are to be three generators, each direct driven by a compound, non-condensing engine. Inasmuch as two voltages are desired, namely, 110-volts, three-wire system for lighting, and 220-volts for power circuits, the arrangement and design of these generators may be proposed in more than one form, to permit delivery of current from the switchboard of either power or lighting voltage from any combination of the generators." A schedule of the power and lights probably required was then given, covering the 24 hours.

The system of shop lighting has been series, constant-current, double-carbon, open arc lamps for general illumination and 110-volt incandescent lamps on alternating circuits. The new system puts the power and lights on the same current, using more than one unit for generating, lessening thereby the probability of a breakdown affecting the continuity of service. Direct-current machinery was chosen on account of its applicability to all the classes of service required, and for three principal reasons: First, for use in crane service, as being best adapted to that work. Second, by reason of the slower speeds of direct-current motors, they are more readily directly belted to line shafts and machines without the use of intermediate countershafting. Third, alternating-current motors are very enticing on account of their simplicity and ease of repair, and I have no doubt that their makers and users have very convincing arguments for their adoption and use; they are, however, far more expensive per horse-power than direct-current motors. Great care has to be taken in wiring for the alternating-current systems to avoid trouble and losses from induction and cross currents. No trouble of this kind is experienced with the direct current if care is taken to properly proportion the wires for their load and the ordinary precautions in regard to insulation are followed. The alternating current certainly has its field in long-distance transmission, where a cheap source of power can be reached and by high voltage be economically transmitted. In such a case the final voltage and its mode of distribution must be determined by local conditions and with special reference to the work to be done.

There were, therefore, electrical, mechanical and financial reasons that determined the use of direct-current transmission in the shops I have named. The plan of the work shows that the power station is by no means the center of distribution, the greatest radius being about 2,000 ft., and it required a 100,000-c.m. cable to transmit the power necessary at the mill. The investment in such a cable, however, was far less than it would have been to install the power-house at an intermediate point so as to reduce this radius and the weight of the copper required.

The plan finally adopted comprised three generators, one 75 and two of 160-k.w. each. The smaller unit being approximately 100 h.p. and the larger ones something over 200 h.p. each, it will be seen that by combinations of the generators, 100, 200, 300, 400 or 500 h.p. may be transmitted to the board. This is believed to be good steam engineering, as it affords an opportunity to work the engines closely within their most economical range of steam using.

The three-wire system of lighting generally requires two generators to be worked in series, but in this plant, for considerations of simplicity, first cost and general convenience, and for the further reason that the plant is primarily a power plant, the arrangement and voltage of the generators were fixed with a view to all these considerations and operated direct to the board at 220 volts. This being also the proper voltage for the outside wires of the three-wire system the means of maintaining proper balance between the two sides was then considered and arranged by using a motor-generator balancer set of 10-k.w. capacity. This machine has its controlling switches on a panel of the switchboard and in a simple manner maintains the balance of the two sides, correcting any inequality of current pressure there may be, due to one side being more heavily loaded than the other.

If the plant was primarily for lights, this plan would not have been adopted, as in that case 110-volt generators, in multiple for lights and series for power, as in the Chicago & North Western power plant, would be advisable. Care being taken in the distribution of the lights on the circuits, the balancer has little to do and is a simple and effective device. The shops are to a considerable extent wired and equipped with incandescent circuits, 110 volts, alternating current, and it is only necessary to straighten out and extend the service, transferring the feeders to the new switchboard.

General inside illumination is provided for by the use of 110-volt inclosed arc lamps on the same circuit as the incandescent lamps, the arc lamps having opalescent single globes and sheet-iron shades painted white. It is believed that this style of arc lamp is best suited for shop-lighting as against the use of double-glass globes with no shades. The shades distribute downward a portion of the light that would be otherwise wasted upward and do not interfere with the lateral distribution of the light.

The question how far individual motor driving should be considered for machines is an interesting one, but it is the belief of the writer that it is not necessary or advisable to consider anything but group driving in the average railroad shop. There is one shop that has been considerably exploited by the consulting electrical engineer who laid it out, that is a shining example of the extreme in individual motor-driving. The published descriptions of this shop state that motors of the following horse-powers are installed: 1, 2, 3, 3.5, 4, 5, 6, 7.5, 8, 9.5, 10, 13, 15, 17.5, 20, 22.5, 25, 35 and 45. There are 94 machines listed, excluding cranes, turn-tables, etc., driven by 68 motors. The machine shop shows 42 machines driven by 29 motors. The arrangement is such that if another machine were to be put in a motor for it would be required. In the Norfolk & Western machine shop there are 133 machines, which will be group-driven by six motors, aggregating not over 100 h.p. A machine may be added to any group without seriously overloading the motor, and as there are several groups we may add a number of machines without change of motors. The additional load would be shown at the switchboard, but by reason of the group system it would add but a small amount to any one motor.

The reasoning in favor of group-driving of railroad shop machinery is on this wise: One machine requiring 1 h.p. may be taken as a unit; individually motor-driven, this machine would take a 1-h.p. motor to operate it, even if it ran but one-half the time, and average machine tools are idle or running light at least that amount for work or tool adjustment. Two or three such tools grouped would not require their full multiple of the unit power, but the full value of grouped driving will be reached, first, when the number of machines in the group will enable the use of a motor of sufficient size for a near approach to good electrical efficiency, which is not possible with small motors; and, second, when the number of machines is such that the proportion of idle time may be so distributed over them as to be practically continuous and effect a proportionate reduction in the power needed in the motor. For example, if one unit takes 1 h.p. and is idle one-half the time, two such units can be driven by a 1-h.p. motor, provided the machines are run alternately, but if both are operated together the motor will be subjected to 100 per cent. overload. If we take 10 such units, however, and use a 5-h.p. motor, the chances are about even that the motor will be driven to its rating, and they are infinitely small as to its ever getting 100 per cent. overload. There is no argument against individual motor driving in case the machines to be driven are large enough or if their isolation is necessary to facilitate movement of material, but we are considering average railroad shop machinery, and in most cases, old machinery already group-driven from shafting.

The extremist in electric driving does not like to use shafting, but as against an almost 100 per cent. increase of total motor capacity required, the low electrical efficiency of small motors and also the high cost per horse-power for small motors as compared with those of moderate size and power, a reasonable length of shafting will in the end prove the best investment for our class of work. In a wood planing mill the case is somewhat different. The power required is so much greater for heavy planers, and other continuously operated machines, that individual driving may be attempted, but even here it may profitably be limited. Saws, shapers, jointers, mortisers, tenoners, band saws, borers, all intermittently operated machines, can be successfully grouped and driven with a fraction of the power required for individual driving.

*A paper presented by C. A. Seley at the Saratoga Convention of the Master Mechanics' Association.

From the table it will be noted that the mill was equipped with a large engine. An indicator test showed that the average power required, including all friction, to be 160 h.p., although for short intervals it ran a little over 200 h.p. It was believed that, by the elimination of the engine friction, the heavy transmission belts, and certain unused lengths of shafting, that 125 h.p. of motors would operate the mill, using seven motors driving 40 machines, all on the group system. It was decided that it would be wise, however, to overrun the calculated power at the heavy end of the shop somewhat and 140 h.p. of motors were ordered.

Other departments that are to be motor-driven in groups are the smith shop, bolt and forging machinery; the forge blowers, together with the flue-shop machinery; the bolt and nut-cutting machinery, together with the smith-shop punching and shearing machinery; boiler-shop machinery; the foundry rattlers, grinders and drilling machinery in two groups, and the foundry cupola blowers are also to be driven with a motor with rheostatic control for varying the speed according to the need for blast. In all 23 motors were ordered, as follows: Three 7.5-h.p., five 10-h.p., three 15-h.p., ten 20-h.p., one 30-h.p., one 35-h.p., aggregating 382.5-h.p. It will be noted that the 20-h.p. motor is ordered in a larger quantity than any other size, it being intended that this should be the standard motor so far as possible. All motors are of the regular commercial type, standard with the manufacturers.

The above described motors are in all cases to be directly belted to line shafting. The writer has seen motors directly attached on the end of line shafting, as at the General Electric Company's shops at Schenectady. At another shop back-geared motors were used directly attached, but the gearing was very noisy and neither of these plans employ strictly standard motors. At the Baldwin Locomotive Works, where both individual and grouped driving are very extensively used, belts are used to the greatest possible extent and in many cases with such short belt centers as to be surprising that good results could be obtained. It was explained that this method was very satisfactory and that after a belt was taken up a few times, in most cases it would run thereafter almost indefinitely, and if it did fail, its replacement was much easier, cheaper and speedier than to repair broken gearing.

On the other hand, many shops employ gear connections between their motors and machines, especially the modern heavy machinery, much of which is now built to be directly driven. Where the gearing can be covered and protected it may do very well, but wear is inevitable and gear breakages are expensive and at times exceedingly inconvenient. There is a very desirable flexibility in a belt connection and if there should be a failure of the motor an extra one can be readily installed if standard types are employed. Some of the electrical companies have developed systems of multiple voltage, which, in connection with double or triple gearing, give a large range of adjustment of cutting speed of tools individually driven, enabling maximum output after proper speed has been determined by experiment. These systems involve the use of considerable gearing, additional wiring and a generating set arranged with reference to the number of the voltages desired. Some of our friends who have installed multiple voltage may be able to enlighten us as to its advantages, but as the writer does not favor individual driving as a rule, multiple voltage was not considered in connection with the plant under discussion.

The description so far has reference only to the regular motors for power purposes to be used at Roanoke shops. In addition to these, various situations have been considered and electrical power planned. Some of these are as follows: The substitution of a motor instead of a rope drive for the machine shop walking crane which operates on a center track running the length of the machine shop and serving heavy tools adjacent thereto. A railroad motor and controller is to displace a steam engine and boiler driving a turn-table. A new 40-ton, 3-motor crane with a 5-ton auxiliary hoist was installed in the erecting shop, and a 25-ton rope-driven crane is to be re-enforced to carry 40 tons and be electrically equipped in a similar manner to the preceding crane for use in the erecting and boiler shops. A rebuilt crane of 15 tons capacity is to be installed in the foundry, displacing a hydraulic crane which could operate over but a small area, while the traveling crane could cover a large portion of the foundry floor. It is probable that in the near future a second turn-table, now hand operated, will be electrically operated, and that electrical power will be furnished to the general office for elevator service.

HELPING ENGINES.*

The economy of using a helper under any given condition is determined by the total cost of transportation with and without the helper, of one ton, or some multiple of this unit, over the division. The conditions may be such as to require no calculation to demonstrate their economy. Or again, they may be such that only a very careful analysis of all conditions and factors is necessary to determine, whether or no, their use will be advantageous. The leading factors in such a problem are: The volume of traffic; ruling grades, their length and rise; the time in which the traffic must be moved, due to competing lines; and the economical train length and tonnage considered in connection with other divisions. The combinations of the variations of these factors furnish an almost infinite number of conditions. Each condition requires separate study and treatment, and excludes from consideration any general law applicable to all. The economy of using a helper, and its tractive power, if desirable to use one, is generally indicated by the average volume of traffic.

Each of the leading factors are subject to many modifications in connection with varying profiles. A few of the more common grade conditions are:

1. A comparatively level division, with the exception of a ruling grade of comparatively short length.
2. An undulating division with heavy grades, and ruling grade only slightly in excess.
3. An undulating division with a comparatively short, heavy, ruling grade.
4. A division with a ruling grade of great length.

Assuming that the above conditions obtain in the direction of greatest volume of traffic, it is obvious that we may have the same or entirely different conditions of grade in the opposite directions. One of two conditions, as regards the size of train, may exist in a general way. In connection with other divisions it may be desirable to have trains of a certain tonnage, for reasons that will be dealt with later; or, for various reasons, the largest train that can be handled by one engine is much less than can be handled satisfactorily by one train crew. Some of the conditions that might result in the latter are: Average size of recently built power, owned; limiting weight of engines, due to bridges, rail, tunnel and other clearances; or a standard road engine of insufficient power on the heavy grades. Where the economical tonnage, as regards handling by the train crew, or a standard train can not be handled by the leading engine under the four general grade conditions, it would seem from a theoretical standpoint to call for a helping engine or engines.

The general conditions referred to divide into two general sub-classes: First, where the length of grade is such that the helping engines are required only for a part of the division, and, second, where the helping engines are required for the whole division, or the greatest part of it. Cases 1 and 3 come under the first sub-division, and cases 2 and 4 under the second. Under some circumstances case 3 may come under both; that is, double-heading over the division, with a helper in addition on the heavy grade.

Where a helper is used only for a part of a division, and the helper is of the same power as the road engine, the tonnage handled over the division is doubled per train; the cost per ton-mile for fuel, wages of engineers and firemen, etc., is lessened in some cases; while the wages of one train crew have been saved in one direction, and if the road engines can handle the tonnage in the opposite direction alone, the wages of a train crew over a division and return have been saved. The light mileage of the helper is offset by the underloading of the two road engines that are necessary to handle the same tonnage without a helper, after passing over the ruling grade. Where double-heading in one or both directions over a division, with leader and helper of the same power, the wages of the second train crew are saved. Where the return tonnage can be handled by the leading engines, there is an additional economy due to the difference in expense of the light mileage of helper, and the underloaded second engine that would otherwise be necessary. In general, where a helper, either over a division or part of it, of equal or greater power than the leader, can be used in connection with normal loading, the economy is real and substantial. As the proportion of power to be furnished by a helper decreases, a point is reached where the economy curve changes direction and becomes negative.

There are certain conditions where the volume of traffic is light, and a certain number of trains are to be run irrespective of their size, which make it more economical to have engines of sufficient power to handle the necessary trains under the grade conditions. When the volume of traffic becomes so great that to handle the trains requires a more powerful engine than can be run, owing to the physical limitations of the right of way, from a theoretical standpoint a pusher or double-heading becomes desirable.

On a trunk line, handling a large volume of through freight between its termini, it would seem that the maximum train that could be handled on the level, the limitations being due to length of train that can be handled with safety, should be its standard train. The size of the standard train may be further limited by the speed, as in fast freights, the lengths of sidings or physical limitations of the right of way, such as bridges, rail, ballast, etc., prohibiting the use of a sufficiently powerful engine. Whatever the limiting factors, a standard train becomes desirable. With it yard work, delays and wear and tear due to shifting are eliminated at each division terminal it must pass from origin to destination. It will readily be seen that the time saved, where a train is brought in by one crew to a division terminal, and immediately taken out by another without shifting, is considerable. The expense of maintenance is also considerably decreased by such an arrangement, as it is safe to say that out of the total cost of repairs to rolling stock more than 50 per cent. of the cause is due to shifting in yards. Under a standard train system it is desirable to have the leading engine of sufficient power to handle the train at the desired speed over the level, or comparatively level, divisions. The power of helping engines on the grades may then vary from a very small to a very large engine. Where no such system is in vogue, and each division handles its traffic to best advantage, independent of the size of train that may be delivered to it, or that it may turn over, the problem is simplified, in that it depends solely on the profiles of the different divisions, and each division can be treated separately.

From the record of a six months' performance of a number of engines of the same class, on the Wilkesbarre mountain grade of the Wyoming Division of the Lehigh Valley, the percentage of cost of the more important items, constituting the total direct cost per ton-mile, was found to be as follows:

	Per cent.
Water supply	0.346
Waste and other supplies	1.167
All oils (lubricating and illuminating)	1.259
Roundhouse men (hostlers, wipers, etc.)	2.478
Interest and depreciation	12.315
Repairs	16.188
Fuel	16.366
Wages of engineers and firemen	21.386
Wages of train crew (exclusive of engine crew)	28.495
Total	100.000

It is apparent that with another engine of the same class as helper the tonnage would be doubled, the cost per ton-mile of all items remaining the same, with the exception of the wages of train crew, which would be decreased 50 per cent. As the cost of this item per ton-mile would be reduced by 50 per cent., and as it is about 28 per cent. of the total cost, the saving would be 14 per cent. on the double tonnage, or 28 per cent. It is also evident that an engine of less power would effect a less saving, and one of greater power a greater saving. These figures would vary under different conditions, but they indicate approximately the proportions of the different items constituting the total direct cost, and show that the direct economy is largely due to cutting down the cost of wages of train crew per ton-mile. There is also an indeterminate saving, where helpers are used, due to the fewer number of trains. Where the volume of traffic is great, and must be handled on a single track, or at least two tracks, in connection with a number of passenger trains, the indirect saving is no inconsiderable item. In some cases, a large volume of traffic may originate at, or near, the foot of a heavy grade; under these conditions it is sometimes advisable to make up the trains at the summit, and handle the tonnage on the grade entirely by helpers, or all except the amount in some cases handled by the road engine when on the way to the summit to take out a train. Obviously the more powerful the helpers the greater the economy until the limiting size of engine is reached.

There are three leading factors which largely determine the limiting size:

1. Weight that can be carried by rail and bridges.
2. Clearances, such as overhead bridges, tunnels, etc.
3. Construction of rolling stock.

There is also a point reached where the coal consumption per hour becomes so great that one or more additional firemen are necessary. Until such time as all cars have very much stronger underframes and draft gear than the average car of the present day an engine with a tractive power of about 50,000 lbs. would seem to be near the economical limit.

An ordinary road engine, unless specially designed for such service, should not be used as the second engine in double-heading, as, in addition to its own power, the frames and draft gear have to transmit the power of the leading engine. Conversely, an engine that is to be used for double heading or pushing should be designed with the service intended for in view. As on heavy grades the maximum power is exerted at slow speeds, all parts should be extra strong, such as frames, rods, axles, crank pins, etc. The wearing parts should have liberal bearing surfaces, and provision for ample lubrication. Tenders of large coal and water capacity should be provided so as to cut out all or as many stops as possible on grade, as the time lost and damage to cars in starting is considerable. Where the grade is comparatively long it is doubtful economy to use a small diameter of driving wheel, on account of the greater power. It would seem a better policy to use a size of wheel that would allow the light engine to make good time down the grade without heating bearings, or shaking the machinery to pieces, and to provide for the necessary power in the steam pressure and the size of cylinders. The front drawhead should be as short as possible; the greater the overhang the greater the leverage tending to break or dislocate it. The breast-beam should be heavy, and preferably of wood, so as to cushion the drawbar shocks. The use of a heavy plate back of the breast-beam sometimes saves a broken cylinder in case of collision. The pilot should be short enough to clear outside-hung brake-beams on freight cars. The guides, especially on four-cylinder compounds, should be tied near the center to prevent springing. The yoke waist sheets should come well out toward the end of guides and be well secured to the boiler. If the waist sheet is in the center only, the frames must take care of the stress, frequently resulting in a fractured frame near the point of attachment. The connection between engine and tender should be flexible, with a spring buffer to absorb shocks. The deck plate or tail bars should be heavy and well secured to frames. The connecting rods should be extra strong, and the main connection on side rods keyed, so as to take up lost motion and prevent pounding. The tender drawbar should be of M. C. B. type, in connection with a friction draft rigging. As the water evaporation is heavy, a good inlet from tank to injector should be provided. A majority of the manufac-

* A paper presented by Mr. F. F. Gaines, Mechanical Engineer of the Lehigh Valley, before the Saratoga Convention of the Master Mechanics' Association.

turers prefer the following sizes of feed pipe in connection with the different-sized injectors: No. 8, not less than 2 in. internal diameter; Nos. 9 and 10, not less than 2½ in. internal diameter; Nos. 11 and 12, not less than 3 in. internal diameter. The clear opening of strainers and tank valves should be the same area as the pipes, while the hose should be ½ in. larger, to provide for decreases due to bends, etc.

Tenders of large size should have the front of sides cut down, where it is not practicable to raise the floor, so as to admit air in summer. The manholes should be large so as to make accurate water stops unnecessary. The underframe should be of heavy steel channels or I-beams. The trucks should have a spring arrangement that will insure steady and smooth riding under either a full or empty tender.

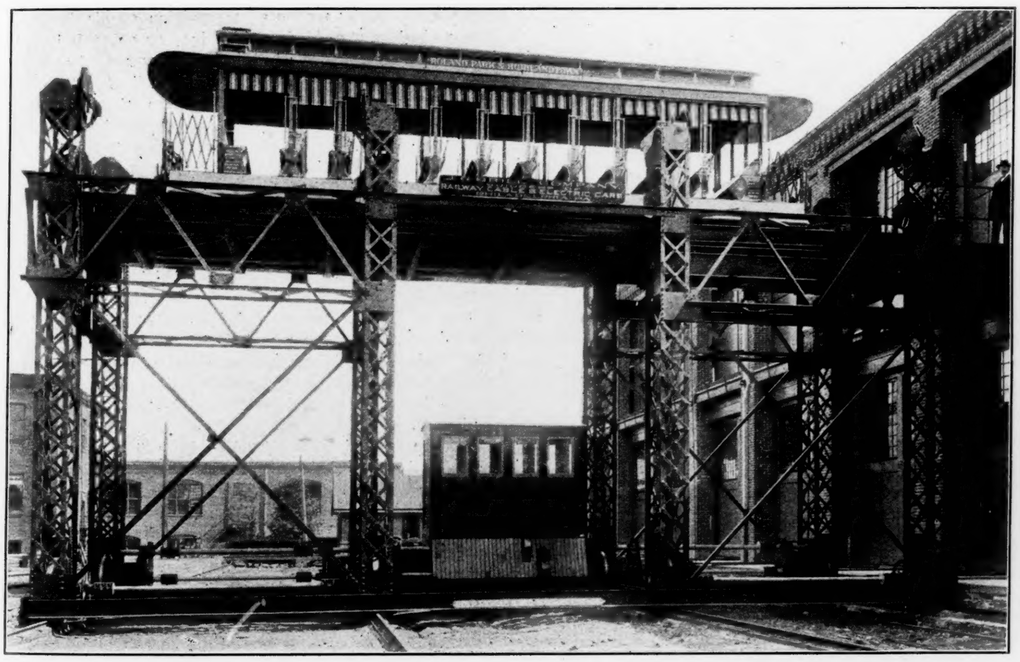
No class of service makes heavier demands on power than helping service, and time spent in careful design so as to produce satisfactory results will be amply repaid by the decreased maintenance charge. In designing, special care should be given to accessibility, both on the road and in repairs. Helping engines are frequently located where they can only receive roundhouse repairs between general overhaulings, so that the desirability of a design to which running repairs can be made cheaply and quickly is very essential.

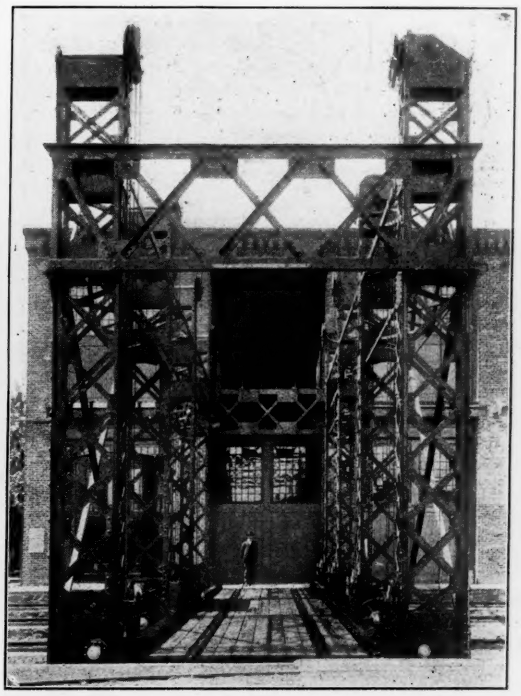
A New Design of Transfer Table.

There has recently been built for the J. G. Brill Co. an elevator-transfer table, as illustrated by the two accompanying photographs. It is designed to take finished cars from a switch track which this table matches and deliver them to the other end of the shop, a distance of about 200 ft. If the car is to be put into a first floor door this table serves only as an ordinary transfer table, but if the car is to be placed on the second floor the lower deck carrying the rails can be hoisted a distance of 19 ft. 5 in. to the proper level. The table is also provided with a winding drum for hauling cars on and off. The total length of the table in the pit is 50 ft., with an 8 ft. overhang to match the rails on the second floor. Its maximum hoisting capacity is 30,000 lbs. and was tested to a load of 40,000. The speed of the hoist is 15 ft. per minute.

The power is furnished by an electric motor controlled from the operator's cab. The hoisting mechanism, the table travel and the winding drum are each operated by means of a friction clutch and are interlocked so that only one clutch can be engaged at a time. Automatic stops are provided which cut off the current to the motors when the table reaches its upper and lower positions. The hoisting mechanism is placed between the motor and hoisting drums and consists of a train of spur gearing. A mechanical brake is provided so that, in lowering a load, a slight amount of power is always required from the motor to overcome the friction. This device makes it impossible for the load to get beyond the control of the operator. The motor is provided with a solenoid brake which checks the momentum of the armature as soon as the current is cut off by the controller. An auxiliary hand brake is also provided for use in case of emergency.

The makers, Messrs. Geo. P. Nichols & Bro., Chicago, tell us that this oufit is entirely new in design and that it is the first one which has ever been installed.





A Combined Transfer Table and Elevator.

The Italian railroads are owned by the State and worked by three great companies, to which it has leased them until 1905. When the employees threatened a strike a few months ago the government interfered and prescribed certain increases in pay and other improvements in the condition of the men, the burden of part of which it offered to assume itself; but the companies are said, in a recent conference, to have declared that they could not bear their part of the increase in cost and to have offered to turn over the railroads to the State now, without waiting for the expiration of their lease in 1905.

Secretary Moseley at Saratoga.

Among the visitors who attended the Master Car-Builders' Convention at Saratoga last week were Mr. Edward A. Moseley, secretary of the Interstate Commerce Commission, and the nine inspectors of the Commission; and Mr. Moseley made an address in which he said:

When I received an invitation to attend this convention, it was a pleasure to accept. I was glad to embrace the opportunity of meeting old friends, and of making the acquaintance of others whom I have long wished to know. . . . Mr. Moseley then complimented the Master Car-Builders on the good work that they have done to promote safety of life and limb, as well as in other directions, and spoke of his pleasant personal relations with many of the members. Continuing, he said:

A bill is now pending before Congress to amend the Safety Appliance Act in which you are especially interested. One feature of that bill is that no cars, locomotives, tenders or similar vehicles shall be used in connection with cars engaged in interstate commerce which are not also equipped with automatic couplers, grabirons, etc. This bill also provides that when cars are equipped with air the air must be used. In appearing before the committee of Congress recently, the question arose in regard to the location and length of grabirons and handholds. I then stated that if the Master Car Builders had established a standard and not "a recommended practice," and if there were a law to make these standards compulsory upon all roads, there would be little if any necessity for legislation. There are many things which the safety appliance law does not deal with, such as steps, ladders and running-boards, and many other things as essential, perhaps, to the safety of the men as those things which the law does require.

I will repeat in regard to the Master Car Builders' Association, that if this association, which has the repairing and building of the cars of the railroads of the United States, could settle on a standard for everything, and the same be adopted by the American Railway Association, I do not think there would be any necessity for further legislation at all, except to make these standards compulsory upon every railroad of the country. But in failure of such uniform standards, and their compulsory adoption, the necessity for legislation is, I believe, imperative.

When the safety appliance law went into effect, the attention of Congress was called to the apparent necessity of designating some one to see that it was enforced. With that end in view, Congress made an appropriation to enable the Interstate Commerce Commission to keep informed regarding the compliance with the act to promote the safety of employees and travelers upon railroads, and to enforce the requirements of said act.

After full deliberation and with the very useful advice of members of the Master Car Builders' Association and others, the commission concluded that the best course to pursue would be to employ inspectors whose duty it should be to examine the freight equipment of the railroads, and make reports of the same which should be transmitted to the presidents of the roads. This policy has been successfully adopted.

The necessity for some definite rules and methods under which the inspectors should proceed, was early realized. One course would have been to enter upon this work with a view to obtaining information which would lead to the prosecution and conviction of those whose equipment was found to be not in conformity with the provisions of the law. It was, however, believed that if the established rules and regulations and recommended practice of the Master Car Builders' Association were followed, there would be no necessity for prosecutions and that this method would be by far the better system. It was therefore suggested to the railroad managers that a code of rules be drawn up, not with a view of setting forth those things which were violations of law, but of determining upon inspection, the proper application of safety appliances, their condition and maintenance, and what would be conducive to the safety of employees in that regard—I might say, that with the approval of the railway management of the country, our rules have been adopted. The result thus far has been satisfactory and there has been no friction; everything has worked along in perfect harmony. The persons employed as inspectors have been selected with the greatest care and only those men were employed whose experience and long training in active railway service had, it was believed, especially fitted them for the position. They agree with me that, to the extent that we follow the rules and practice of this association, they are safe. They have accompanied me to this meeting in order that they may make acquaintances that may be of value to them and to you, and that we may obtain your views upon these questions with a view of acting upon them.

Before closing, I believe it will prove interesting to point out by way of a few statistics the remarkable and beneficent results that have been attained by the Act of 1893, which became of full effect on the first of August, 1900.

The improved conditions are gratifying and can be evidenced by making a cursory comparison of the accidents in 1893 with those in 1901.

The statistics show that in 1893 there were 310 persons killed and 8,753 injured from accidents from coupling and uncoupling cars. In 1901 there were 163 killed and 2,370 injured. In 1901 only one-fourth of the casualties of those in 1893, and 12,000 more trainmen employed and at risk.

In the case of accidents from falling from cars, trains and engines in 1893 there were 507 persons killed and 2,984 injured, while in 1901 there were 374 killed and 3,144 injured, an increase of 17 casualties, but there were 12,000 more men employed.

You will notice then that while the results are most gratifying when comparing the accidents from coupling and uncoupling cars, in the case of the accidents sustained by falling from cars, trains and engines, that while there is a decrease in the number killed, there is an unfortunate increase in the number injured. The introduction of automatic couplers, the use of handholds and compliance with the law fixing a standard height for drawbars has created the increased security to life and limb in the former case.

On the other hand, in the case of accidents from falling from cars, trains and engines, the increased number of casualties is, I believe, due to the fact that air-brakes are not yet as generally used as they should be and will be. But with the uniform use of the air-brake on freight trains without doubt there will be a considerable decrease in the number of deaths and injuries. . . .

A movement having been made to organize a union of Austrian locomotive engineers, the Minister of the Interior forbade it last December. The courts were appealed to, on the ground that the prohibition by the ministry was a violation of the citizens' political rights of association. The Imperial Court last April decided

that the minister did not exceed his authority and was justified in estimating the danger to the state of such a union, not from its articles of association alone but by the actual circumstances which might enable it to constrain the government and the railroads.

M. N. Forney's Feed-Water Heater for Locomotives.

[The description which follows is from advance sheets of a pamphlet by Mr. Forney.]

. . . The feed-water heater which is illustrated herewith has been designed with a full appreciation and due consideration of the difficulties previously experienced with locomotive feed-water heaters and for the purpose of obviating and overcoming them.

The gases of combustion each carry away with them large amounts of waste heat. To utilize some of this the heaters here described have been designed to heat the water in two stages—first by the exhaust steam and then by the waste gases. For clearness and brevity the heater in which the exhaust steam is used as the agent for heating will be called the "exhaust-heater" and the other the "fire-heater."

Fig. 1 represents a side view and Fig. 2 a longitudinal section of the front end of a locomotive boiler and smoke-box, with an exhaust and fire-heater; 13 is the fire-heater, which is bolted to the front end of the smoke-box by angle-iron flanges 23, and 26 is the exhaust-heater, located below the fire-heater. Fig. 3 shows two vertical half-transverse sections, the right-hand half taken on the line *a a* of Figs. 1 and 2, looking forward, and the left-hand half on the line *b b*, looking in the same direction.

The exhaust-heater 26 consists of a crescent-shaped vessel made to conform to the contour of the cylindrical fire-heater 13 above it. The outside shells of both are made of boiler-plates, excepting the ends 28 28′ of the exhaust-heater, which consist of cellular castings having double plates with water-spaces between them. It is provided with a series of bent tubes 27 27′ 27″, Fig. 3, which are connected to the inner plates of its heads. The spaces between the plates are divided by partitions, one of which, 32, is shown to the left side of Fig. 3, and another 32′ is represented by the serpentine lines in Fig. 5, which is a half sectional view of one of the heads of the heater, drawn on the line *e f* of Fig. 3 and looking in the direction of the dart *d*.

The tubes are bent to correspond to the form of the heater and to permit them to be expanded and contracted by changes of temperature.

The feed-water is conducted from the pump or injector to this heater by the pipe 30, shown in Fig. 1, and also on the right side of Fig. 3 and in Fig. 5. The direction of the flow of water is indicated by the arrows in the pipe 30 and 30′, Figs. 1 and 5. From the latter figure it will be seen that the water passes from the pipe 30′ to the chamber 30″ and downward to 30‴ and thence into the tubes 27. In order to indicate in the end view of the tubes, in Fig. 5, the direction of the flow of the water an × mark is used to show that the flow is *from* the observer and a — mark that it is toward him. From the two figures last referred to it will be understood that the water enters the lower series of tubes 27 27—which are represented by dotted lines on the right side of Fig. 3—and flows through them to the chamber 33 on the left, as indicated by the arrows. There the current is reversed and flows back toward the right, through the tubes 27′ 27′, to a chamber at the right hand and adjacent to 28′, where the current is again reversed and the water flows back through the tubes 27″ 27″ to the chamber 34, from which it is conducted to the fire-heater 13 above by the passage 35.

Exhaust steam is conducted from the exhaust pipes 21, of the cylinders, to the exhaust heater, by two pipes 22 22, shown in Figs. 1, 2 and 3. The bent heating tubes 27, 27′ and 27″ are thus surrounded and exposed to exhaust steam while the engine is working. The heating tubes being exposed to this steam some of its heat is transmitted to the water inside of them. As the water must flow to and fro through them three times, it is exposed for a considerable time to the heat of the exhaust steam by which they are surrounded.

The transmission of heat to the water necessarily results in the condensation of some of the steam, but its place is immediately filled by a fresh supply from the exhaust pipe, the pressure in which will necessarily force the steam into the heater as condensation goes on. The water of condensation may be discharged from the heater by the blow-off cock 37.

The exhaust-heater represented in the engraving has 88 tubes 2 in. in diameter, and their average length is 50 in., so that they have nearly 200 sq. ft. of heating surface.

It is a well-known fact that the effect of heating many kinds of water is to cause it to deposit its impurities as soon as it gets hot. With such water the result would be that the heating tubes would soon become filled with solid deposit unless they were periodically cleaned. To facilitate this each of the tubes of the exhaust-heater has a hand hole and cover 29, Figs. 3 and 4*, opposite to its end. One of these is shown on an enlarged scale in Figs. 6 and 7. By unscrewing these covers access may be had to each tube from the outside of the locomotive and they may be cleaned from end to end by using a flexible scraper, or any tube may be caulked or removed through the hand-hole opposite its end and a new tube put in its place.

The fire-heater 13, shown in Figs. 1-3, consists of two series of heating-tubes 5 5 and 7 7, Fig. 2, inclosed in a cylindrical shell which is attached to the front of the smoke-box. This shell has suitable heads 24 and 25 to which the heating-tubes 5 5 and 7 7 are connected, and it contains the water to be heated, which surrounds the tubes. The waste gases from the boiler before they escape out of the chimney are caused to circulate through these heater-tubes by means of a partition or diaphragm in the smoke-box, provided with a door or valve 1 1, by which the lower portion of the smoke-box may be separated from the upper part *c* and—as indicated by the arrows—the products of combustion are thereby conducted from the boiler tubes 4 4 through the lower portion of the smoke-box to the lower tubes 5 5 of the heater, and through them to a chamber 6 in front of it, and then back through the upper tubes 7 7 to the top chamber *c* of the smoke-box and thence to the chimney 11. The door 1 1 is attached to a transverse shaft 2, which can be turned by a lever 3, Figs. 1 and 2, on the outside of the smoke-box, and a rod 3a, which connects the lever with the cab, thus raising the door into the position represented by the dotted lines at 24 in Fig. 2. Communication is thus opened from the lower chamber of the smoke-box to the upper one and the chimney, so that the smoke and waste gases can then pass directly from the boiler tubes 4 4 to the smoke-box and out of the chimney.

Under the normal condition of working this door would be closed and the smoke and products of combustion would pass through the heating-tubes, as indicated by the arrows. If, however, for any reason it would be essential

* Fig. 4 is a half view of the end of the heater, looking at it in the direction indicated by the dart *c*.

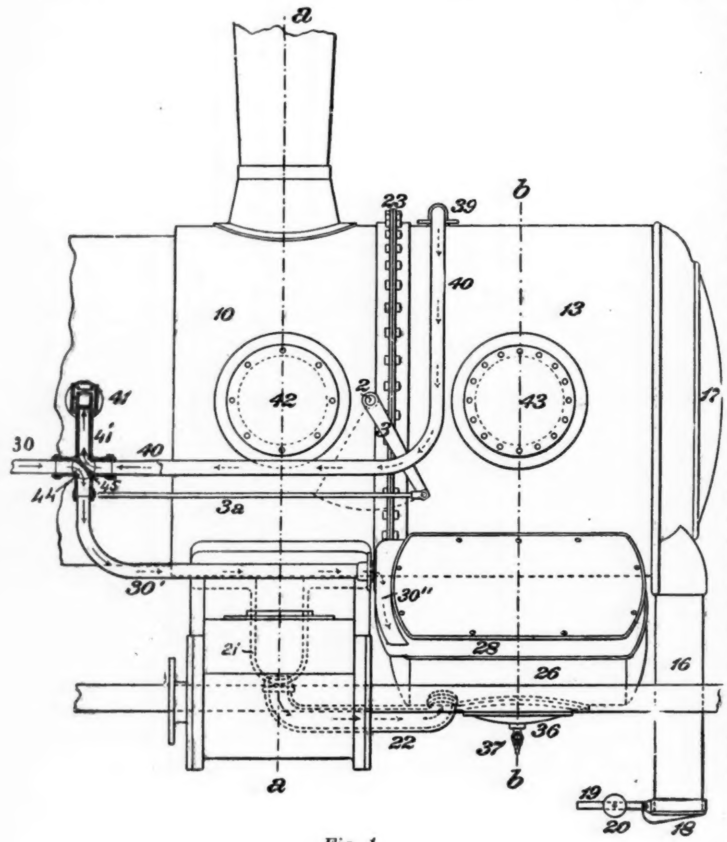


Fig. 1.

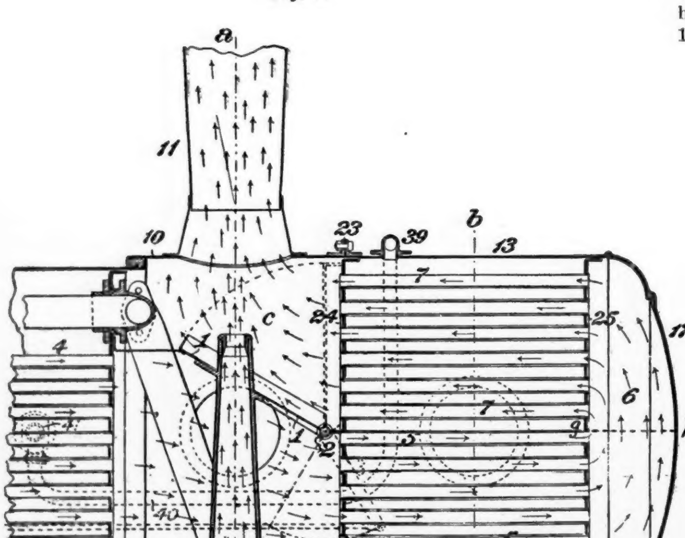
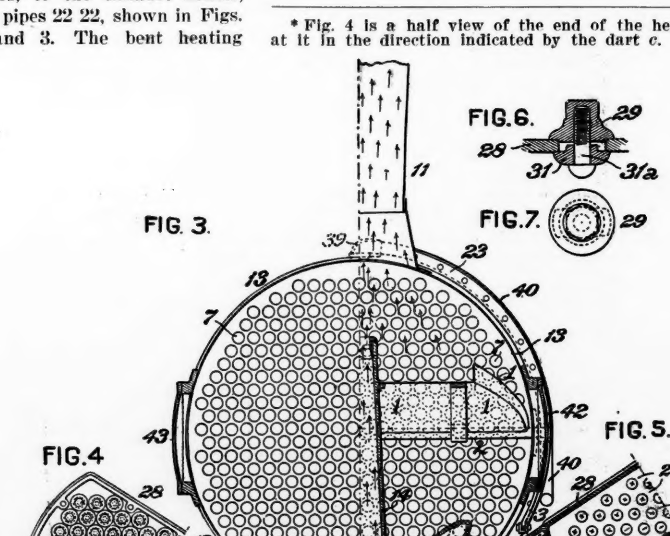


Fig. 2.



Figs. 3 to 7.

Forney's Feed-Water Heater for Locomotives.

to increase the draft on the fire, or if any part of the heater should fail, then the door would be opened, and the smoke and gases would escape directly up the chimney.

The heater represented has 412 2¼-in. tubes, 3 ft. 8 in. long, and has 890 sq. ft. of heating surface. The temperatures in the smoke-box, when a locomotive is working under steam, vary from about 400 deg. to 1,200 deg. With that amount of heating surface and such temperatures a very large amount of heat would doubtless be transmitted to the feed-water—how much cannot, of course, be determined, excepting by actual test, but, as already pointed out, these figures indicate not only the possibility, but the probability, of a saving of a very large percentage of fuel, and, in places where bad water is used, a very material saving in the cost of boiler repairs, by arresting the solid constituents of the water and depositing them in the heaters, and thus excluding them from the boiler.

From Figs. 1 and 2 it will be seen that the fire-heater is made separate from the smoke-box, and is bolted to it by angle-iron flanges 23, so that the heater can readily be detached from the smoke-box to make repairs in the latter. A manhole 42, Fig. 1, is also provided on one or both sides of the smoke-box to permit of ingress and egress to and from it without detaching the heater.

When a feed-water heater is used the consumption of steam by an injector is a matter of much importance. It is a fact established by careful experiments that with a steam pressure of 200 lbs. it takes about 10 per cent. of all the steam generated by a boiler to operate the injector, or in other words it takes 1 lb. of steam to put 10 lbs. of water into a boiler. It is true that a considerable quantity of the heat of this steam is imparted to the water and is returned to the boiler, so that it is not wasted, but a pump operated by steam working expansively will require only about one-tenth or one-twelfth as much steam as an injector to force a given quantity of water into a boiler. The pump, however, will not heat the water, but if a boiler is fed with a pump and the feed-water is heated by exhaust steam or the waste gases, then clearly there is a saving of about 9 per cent. of all the steam generated, because the pump takes only about one-tenth as much steam to work it as an injector does, and if the feed-water from the pump is heated it may be delivered into the boiler at the same temperature as it is by an injector.

To get the full advantage of heating feed-water it is therefore essential to feed with a pump and not with an injector, excepting when the engine is standing still or in emergencies. It is therefore proposed, in using the feed-water heater here described, to feed the boiler in regular service with a pump having a variable stroke, so that the quantity of water fed can be accurately regulated to the amount of work done.

It will be seen from Fig. 2 that when the door 1 is in the position in which it is shown in full lines the upper part *c* of the smoke-box 10 and the chimney 11 are separated from the lower part of the smoke-box and that the smoke and gases which pass through the boiler tubes 4 must then take the course indicated by the darts—that is, they must pass forward through the lower series of heating tubes 5 of the fire-heater into the supplementary smoke-box 6. As the effect of the blast is to produce a partial vacuum in the upper part of the smoke-box, the contents of the supplementary smoke-box 6 will be drawn backward into the upper part *c* of the main smoke-box 10, through the upper tubes 7 of the heater, and will then be carried upward and out of the chimney 11, as indicated by the arrows. As it is essential that there should be sufficient sectional area in the tubes of the heater to permit the products of combustion to pass through them freely and as in a heater of this kind all the smoke and gases which pass through the boiler tubes must pass through one-half of the heater tubes and return through the other half, it is essential to provide as many of them and make them of as large a size as possible. As little or no steam will be generated in the heater, there need not be any room provided in it for steam, nor is it requisite to make any provision for the escape of steam from the tubes. Therefore the whole of the cylindrical portion or shell 13 of the heater is filled with tubes and with water. The centers of the tubes are placed directly opposite those of the boiler tubes 4, and in order to make it possible to remove any of the latter without disturbance to the heater the heater tubes are made of sufficient internal diameter so that the boiler tubes will pass through them, and the latter can thus be removed through the former and new ones substituted. The heater tubes being of enlarged diameter have each a greater sectional area than the boiler tubes, and although there will be less free water space between them, if the tubes are enlarged, this is not of much importance in a heater, because little or no steam is generated in it, and, therefore, as has been explained, it is not requisite to provide room or means for its escape from the heating surfaces. By making the tubes in the heater larger than the boiler tubes and spacing both the same distance apart and making the diameter of the heater somewhat larger than that of the boiler, so that the total number of tubes in it can be increased, the internal sectional area of one-half of the heater tubes will be nearly or quite as large as that of all the boiler tubes. As the smoke and gases pass first through the lower series of heater tubes and then return through the upper ones, the products of combustion have a double "run" through the heater tubes, and thus the period of contact of the escaping smoke and gases with the heater tubes is doubled, which facilitates the transmission of the heat that they contain to the water by which they are surrounded. When the feed-water is delivered from the exhaust-heater, as described, it will be heated to a temperature approximating to that of the exhaust steam, which is about 240 deg. It will then come in contact with the heating surfaces in the fire-heater, which are exposed to the waste products of combustion that escape from the boiler tubes. The temperature of these varies between wide limits, but experiments have shown that they are sometimes as high as 1,200 deg. Consequently, if the feed-water, after being heated by exhaust steam to a temperature somewhat below 240 deg. (that of the exhaust steam), is then brought in contact with surfaces heated by the waste gases of combustion, another very considerable increment of heat will be absorbed by the water, provided there is enough heating surface, so that the water will be in contact with it a sufficiently long time.

By the construction herein described a large amount of heating surface is provided in the fire-heater. The water is then admitted to or near its lower portion and escapes through the nozzle 39 at its top and is conducted by a pipe 40 to the check-valve 41, Figs. 1 and 2, and thence to the boiler. The fire-heater is therefore entirely filled with water which is in contact with its heating surfaces for a period of time equal to that required for the consumption of a volume of water in the boiler equal to the contents of the heater.

When the smoke and gases which pass through the boiler tubes 4 enter the smoke-box 10, the upper current comes in contact with the under side of the door 1, which thus acts as a deflector and has the effect of directing the sparks and cinders downward, and when the products of combustion enter the smoke-box its enlarged and free space permits them to become partially quiescent, which allows some of the sparks and cinders to fall and be deposited at the bottom. To facilitate their escape therefrom, a large tube 15, Figs. 2 and 3, is provided in the lower part of the heater, into and through which the sparks and cinders will be carried by the draft. At the bottom of the supplementary smoke-box 6 a spark receptacle 16 is attached, into which the sparks will be carried from the tube 15. It will also occur that in passing through the lower series of tubes the sparks and cinders which are carried through the boiler tubes will come in contact with the internal surfaces of the heater tubes. These, being surrounded with comparatively cold water, are of a correspondingly low temperature. The effect of the contact of the incandescent sparks with these cold surfaces will be, as has been explained, to extinguish them, and as the direction of the movement of the smoke and gases is changed when they reach the supplementary smoke-box 6 and these are then turned upward the sparks and cinders will be projected against the front 17 and their movement will thus be partially arrested and they will then be likely to fall to the bottom and into the receptacle 16. This construction thus acts as an efficient spark arrester. As the receptacle 16 would soon be filled with sparks, it will be essential to remove them from time to time. To do this and exclude air from the smoke-box while the locomotive is at work, a door 18 is provided at the bottom of the spark receptacle. This is hinged on one side and opens downward, as indicated by the dotted lines, and it is fitted to its bearings so as to be as near air-tight as is practicable. The door is provided with an arm 19 and a counterweight 20, sufficiently heavy to close the door and keep it closed when the receptacle 16 is empty. When the locomotive is working with steam, a partial vacuum is formed in the smoke-box, which causes the external air to exert a pressure on the under side of the door 18, which will keep it closed, even though the space above it is partially or entirely filled with cinders. As soon as steam is shut off, however, and there is no longer a partial vacuum in the smoke-box and no pressure on the under side of the door the weight of the cinders above, if the receptacle 16 is even partially filled, will be sufficient to overcome the gravity of the counterweight, and the door will open and discharge the cinders which are above it. As soon as they have escaped the action of the counterweight will close the door again, and it will be kept closed until there is another deposit of cinders in the receptacle 16 and steam is again shut off. If desirable, the action of this door could be controlled from the cab by suitable connections.

No netting is shown in the smoke-box, but should it be needed it could be placed in the supplementary smoke-box 6 as indicated at *g h*, and also below the door 1 1 in the smoke-box.

From Figs. 2 and 3 it can be seen that if the exhaust heater 26 26 was filled with air, it might to a very great extent prevent the exhaust steam from entering or coming in contact with the heating tubes. For this reason a pipe 38 (see Fig. 2) is provided to allow the air in the heater to escape. This pipe is connected with the receptacle 16 for sparks. After all the air in the heater has been discharged exhaust steam will escape from this pipe into the receptacle for sparks, the effect of which will be to extinguish them.

To provide for the contingency of the failure of the heater by the bursting or collapse of a tube or pipe or other cause, and to prevent the engine from being disabled thereby, the feed pipes are connected to a four-way valve or cock 44, Fig. 1. The feed pipe 30 is connected with the pump or injector; 30′ is a continuation of the feed pipe and is connected to the exhaust-heater; 40 is a delivery pipe and connects the fire-heater with the valve 44, and 41′ connects it with the check valve 41. The valve 44 is provided with a plug 45 which, when the heater is in condition to work, is set in the position in which it is represented. The feed water can then flow, as indicated by the arrows, from the pump or injector through the pipe 30 and the passage in the valve 44 to the pipe 30′, and thence to the exhaust-heater. The course through that has already been explained. After passing through it it enters the fire-heater, as described, and escapes at its top through a connection 39 and the pipe 40 to the valve 44 and through the passage shown to the check valve 41, and thence to the boiler. In case of the failure of any part of the heater, so that it would be necessary to shut off the water from it, the plug 45 of the valve 44 would be turned into the position represented by dotted lines. The water would then flow from the pump through the pipe 30 and the passage in the valve directly to the check valve and boiler, and the pipes 30′ and 40 would be shut off from it. At the same time the door 1 1 in the smoke-box would be opened so that the smoke and gases would escape direct up the chimney and thus would not pass through the fire-heater tubes. By these means the engine would not be disabled by the failure of the heater and, in fact, if it was important to do so, the position of the plug of the valve 44 could be changed and the door in the smoke-box be opened without stopping the engine.

It is intended to use this form of heater in localities where the water is comparatively pure or contains sediment which does not solidify and can be readily washed out. To facilitate the latter manholes 43 are placed on each side of the heater, which will give access to its inside, and suitable blow-off cocks would be provided.

[Mr. Forney here presents a design of fire-heater especially adapted to the use of impure water. The details have been modified to permit of easy access to the tubes for the purpose of removing any deposits of scale.]

While the construction for heating the feed-water by exhaust-steam and that for heating by the waste products are here described as operating in connection one with the other, and while such a combination is considered advantageous, it is not essential that they should be combined, but either could be worked separately, and thus secure its own measure of economy. It is also to be noted that any of the fire heaters, or a portion of any of them, may be used for heating steam before it enters the cylinders or in its passage from one cylinder to another. By passing it through some or all of the heating-tubes part of the heat of the products of combustion would be communicated to the steam, which would thus be superheated. A portion of the tubes of any of the heaters may be used for this purpose, and the others employed for heating water, or all might be used for heating steam. All that would be required in such case would be to provide suitable pipes and valves for conducting the steam to and from the heating-tubes.

There can be no question of the fact that every 12 deg. of heat added to the feed-water will save 1 per cent. of fuel. With temperatures in the smoke-box varying from 400 deg. to 1,200 deg., and over 1,000 sq. ft. of heating surface in the heater, it does not seem over sanguine to expect that the temperature of the feed-water can be increased 360 deg., or raised from 60 deg. to 420 deg., which would give an economy of 30 per cent. and increase the capacity of the boiler in like proportion. Besides these advantages, if the incrustation, instead of being deposited in the boiler, can be collected in the heater, a very great economy will result in the saving of repairs of boilers, besides increasing the time that engines will be in service.

The weight of the heater, which will be about 10,000 lbs., may be urged as an objection to it. With mogul and consolidation engines this must be carried on the pony truck in front, and it may in some cases be essential to increase the size of the axles and other parts of the truck to carry this extra weight, but in new engines there will be no difficulty in distributing the weight and proportioning the parts satisfactorily.

From the preceding description it will be seen that this heater has the following advantages:

1. An ample amount—over 1,000 sq. ft.—of heating surface.
2. The insides of all the water tubes are accessible and can be thoroughly cleaned, caulked or be replaced from the outside of the locomotive.
3. They are all entirely free to expand and contract, thus relieving them and the parts to which they are attached from strains and the consequent deterioration and corrosion.
4. The fire-heater shown in Fig. 8 can be readily removed from the smoke-box and be cleaned externally or repaired.
5. If any part of the heater should fail the water and waste gases can be shut off from it, and the water fed direct into the boiler, and the waste gases be conducted to the chimney, so that the engine will not be disabled by the failure of the heater.
6. The only care which will be required to operate the heater will be to remove the sediment and incrustation from the tubes.

The cost of the heater has not yet been ascertained, but if it will lessen the consumption of coal from 25 to 30 per cent., increase the capacity of the boiler in like proportion, arrest the solid constituents of the water before they enter the boiler, and consequently materially reduce the cost of boiler repairs, and keep the engine in service a greater proportion of the time, these advantages should be some indication of its value to railroad companies.

A Comparative Study of Steam and Electric Power for Heavy Railroad Service.*

BY BION J. ARNOLD.

In August, 1901, the writer was commissioned by the New York Central Railroad Company to study the conditions governing the operation of its trains between Mott Haven Junction and Grand Central Station, and to report upon the feasibility of operating them by electricity. This division consists of 5.3 miles of four track road forming the trunk line, or main artery over which the trains from the three divisions of the New York Central and the main line of the New York, New Haven & Hartford Railroads enter the city of New York. For 2.58 miles from Mott Haven Junction the tracks are carried on an elevated stone and steel structure; then for 2.04 miles through a tunnel underneath the street, emerging into an open cut .68 of a mile long, then terminating at the Grand Central Station in an intricate stub-end yard, having about eight miles of switching tracks.† Over this division are made nearly 600 train movements per day.

The annoyance to passengers due to the use of steam locomotives in the tunnel, caused the company to examine into the advisability of adopting electricity, and it is through the courtesy of Mr. W. J. Wilgus, chief engineer of the company under whose directions the investigation was made, that the writer is allowed to present to this Institute the technical substance of this report.

Soon after taking up the work it became evident that the most practical and satisfactory way of ascertaining the power required to propel the trains was to measure, by means of a dynamometer car, the "drawbar pull" of a sufficient number of trains of various weights, to determine the average power required per train and from this compute the general load diagram.

A dynamometer car known as "Test Car No. 17,"‡ owned jointly by the Illinois Central Railroad Company and the University of Illinois, was secured, and men thoroughly skilled in its use were employed to operate it. This car was coupled between the engine and the train in each case, and operated on trains running over the different divisions of the road, so that not less than four runs, two or more in each direction, were made for each class of train. Since the trains of all divisions, including those of the New York, New Haven & Hartford Railroad, run over the New York Central tracks between Mott Haven Junction and Grand Central Station, the records of the New York Central trains for this division will apply to trains of equal weight on the New York, New Haven & Hartford road, and were so considered in the calculations. . . .

Method of Obtaining Horse-Power at Drawbar from Dynamometer Records.—This was obtained in general in the following manner: From actual dynamometer car tests the average drawbar pull of the various trains over the various runs was determined, proper allowance made for increased train weight due to motor equipment, and finally a reduction of the drawbar pull thus obtained to horse-power, and eventually to kilowatts. Owing to the fact that the maximum speeds on this division seldom exceed 35 miles per hour and that the trains were never less than three cars in length—often reaching 11 cars in length—no correction was made for head end air resistance.

The successive steps were as follows:

(1) In order to determine the average drawbar pull for any given period, the entire area under the dynamometer pen record was found by a planimeter and divided by the length of base of the interval from start to stop, the result being the average height of card. This average height when multiplied by the constant of the instrument, represents the average drawbar pull.

(2) From passenger records taken during dynamometer tests, the curve shown in Fig. 1 was plotted, showing the ratio of the weight of the live load to the light weight of the train.

(3) Dividing the average pull in pounds by the total weight of the train, the average pounds per ton drawbar pull over the run under consideration, was obtained.

The average pounds per ton drawbar pull (not tractive effort) for various lengths of run over the Mott Haven Division are shown in Curve 1, of Fig. 2. Curves 2 and 3 show these values for longer runs, as obtained on the Harlem and Hudson Divisions respectively, and Curve 4, which is the mean of Curves 1, 2 and 3, shows very roughly what may be expected to obtain as the average value of the "pounds per ton" drawbar pull under ordinary steam railroad conditions, on a level and comparatively straight track, with various weights and length of train (three to ten cars, 100 to 400 tons), and at an average speed of about 30 miles per hour.

The question of grade is here eliminated for each point shown represents the average value of two runs on the same train, one North, the other South.

The number of variables entering into these values such, for example, as the degree of skill of the engineer, the wind velocity, the condition of the track, agreement with schedule time, etc., make it impossible for any curve to pass through all its points and therefore, as above stated, these curves can only be taken as indicating the average value of a widely varying quantity.

(4) Graphical methods were deduced by which the speed in miles per hour could be obtained when the time of run between two stations is known.

(5) The weight of every train arriving or leaving the Grand Central Station on a given day was obtained, and its average speed between stops determined. Knowing, therefore, the average drawbar pull in pounds required to haul a train, and the average speed at which this drawbar pull was exerted, the horse-power at the drawbar becomes:

H.P. = foot pounds per minute /33,000

= drawbar pull × miles per hour × 5,280/33,000 × 60

= drawbar pull × miles per hour /375.

Here again graphical methods are presented from which, knowing the drawbar pull and speed, the horse-power or kilowatts corresponding thereto is determined.

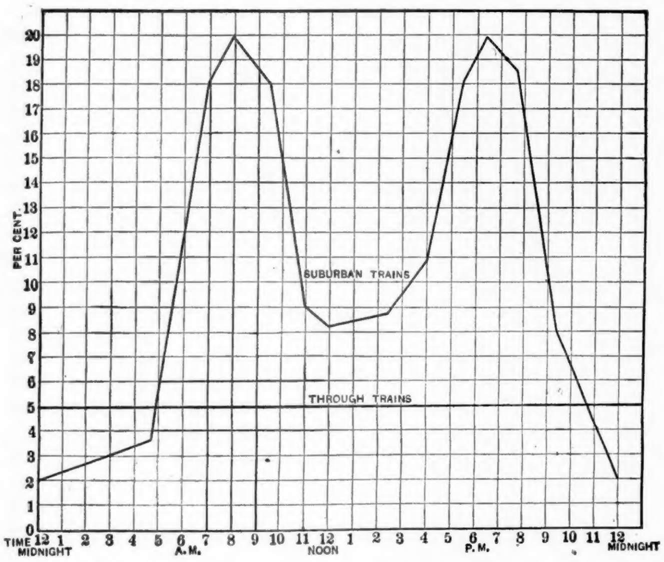


Fig. 1.—Ratio of Weight of Live Load to Light Weight of Train.

Method of Obtaining Daily Load Diagram.—From a careful examination of the weights of all locomotives now in service on this division, it was found that properly powered electric locomotives having a total weight of 65 tons each, all of which would be available for tractive effort, could satisfactorily perform the service of existing steam locomotives.

To each *train* horse-power curve,* therefore, is added the horse-power required to propel a 65-ton locomotive. This horse-power was obtained in the same manner as that required to haul the train and was plotted separately on the train sheets; evidently, the friction of an electric locomotive in pounds per ton is greater than an equivalent weight of train, but this difference was considered in selecting the proper locomotive efficiency. The sum of the instantaneous values of these individual curves was then plotted. The mean height of this curve was next plotted on each sheet, and represents the average horse-power required to propel all schedule trains and locomotives during the six hours covered by the sheet. This average horse-power when converted into kilowatts by means of the following formula:

k.w. = h.p. × 746/70 per cent. × 1,000

where 1,000 watts = 1 k.w.

746 watts = 1 electrical h.p.

and 70 per cent. = efficiency of locomotives

gives the average kilowatt input required at contact shoes of electric locomotives for the period covered by each sheet.

Another curve is plotted which represents the mean average kilowatt input at contact shoes (for line service only) throughout a period of 24 hours, under the same conditions.

The switching, shop train and return engine service was also found.

Finally a curve is plotted which represents the *average daily kilowatt input required at contact shoes of locomotive for all service.* Curve 1 of Fig. 3, is a condensed load diagram of the entire service, showing the hourly variation of the different classes of service.

It was found that the daily average input required would be at the rate of 1,800 kilowatts and, therefore, the total annual input required at the contact shoes of the locomotives, for propulsion alone, would be (1,800 × 24 × 365) = 15,768,000 k.w. hours). From the total number of tons hauled yearly over this division, including passenger, shop trains and switching service, the ton-miles per year were found to be 250,285,710. Hence, the electrical energy required to haul a ton one mile over this division under the existing conditions would be 15,768,000,000/250,285,710 = 63 watt hours per ton-mile.

With this figure as a basis and the load factor as determined from the load diagram, the problem of determining the best method of producing, distributing and applying the power was considered.

Choice of System.—While it is the writer's opinion that the alternating current railroad motor will yet prove to be the most efficient all things considered, for long distance railroad work, it has not yet in his opinion demonstrated its ability to start under load as efficiently or to accelerate a train as rapidly as the direct current motor. The line under immediate consideration was short, the trains numerous and rapid acceleration desirable, all of which are conditions favorable to the direct current motor.

Furthermore, direct current motors with their necessary auxiliaries have become fairly well standardized and it is the only class of electric railroad apparatus available from the manufacturers of the United States without involving experimental work and large development expense.

In view of these facts and the probable necessity for rapid construction, the writer refrained from advising anything of an experimental nature and, therefore, recommended the direct current system in combination with the third rail for the main line, and overhead construction for the yards, all of which have demonstrated fully their ability to meet the conditions imposed by railroad operation so far as motive power is concerned, although there has not yet been an electric installation on any existing terminal that is as complex, or into which anywhere near the number of heavy trains enter as on this section of road.

Had the length of road under consideration been considerably greater, and had it been thought possible to secure sufficient time to conduct experiments or invite demonstrations by manufacturers of alternating current motor equipment, this class of apparatus would have been more seriously considered.

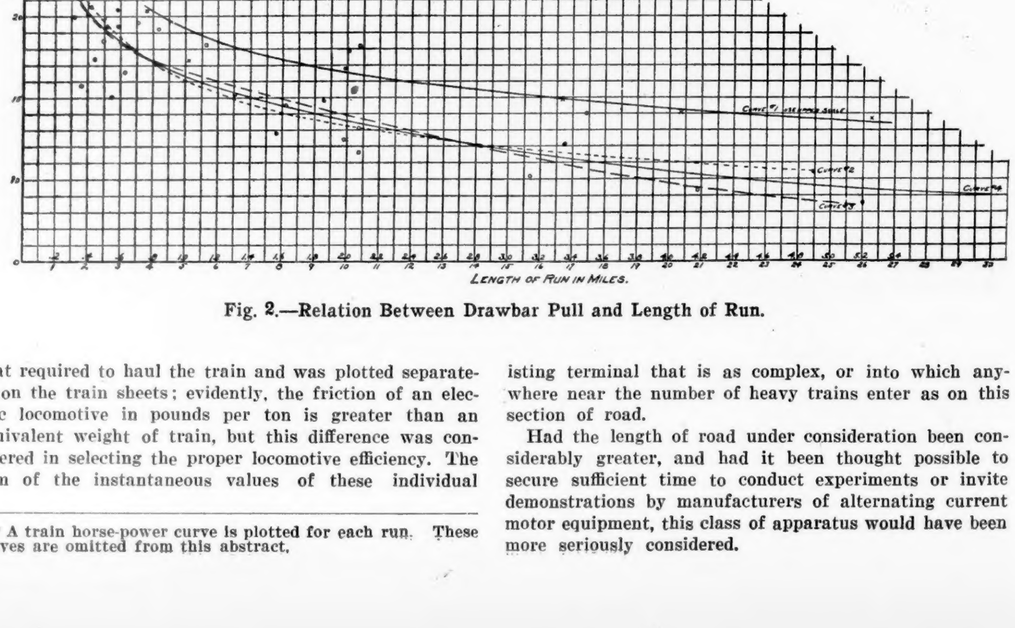


Fig. 2.—Relation Between Drawbar Pull and Length of Run.

* Presented at the Convention of the American Institute of Electrical Engineers, June 19, 1902.

†For description of yard see the *Railroad Gazette*, March 22, 1901.

‡Described in the *Railroad Gazette*, June 7, 1901, p. 382.

* A train horse-power curve is plotted for each run. These curves are omitted from this abstract.

Discussions and Analysis of Plans and Estimates.—In the preparation of estimates, 12 distinct plans of generation and distribution were considered and the results tabulated as shown in Table I. All the estimates were computed upon the same basis so far as cost of fuel, labor and losses in transmission were concerned.

While the results in Column VI. of Table I. indicate that Plan No. 1 was the most advisable one to adopt, it was not seriously considered for the reason that it necessitated locating the power station in a part of the city where its erection would probably have been prohibited by the city authorities, but it was here introduced for comparison as indicative of the economy to be gained by placing the power station at the theoretical center of distribution. The same objections apply to Plans 2 and 3. Plans 4 and 5 bring out quite clearly the difference in the cost of operation between two sub-stations and one, both plans permitting the location of the power station on the river front. The difference in favor of Plan 5 is entirely due to the saving in labor of one sub-station. Plans 6, 7 and 8 were studied with the object of ascertaining whether the purchase, instead of the generation of power, would offer a satisfactory solution of the problem.

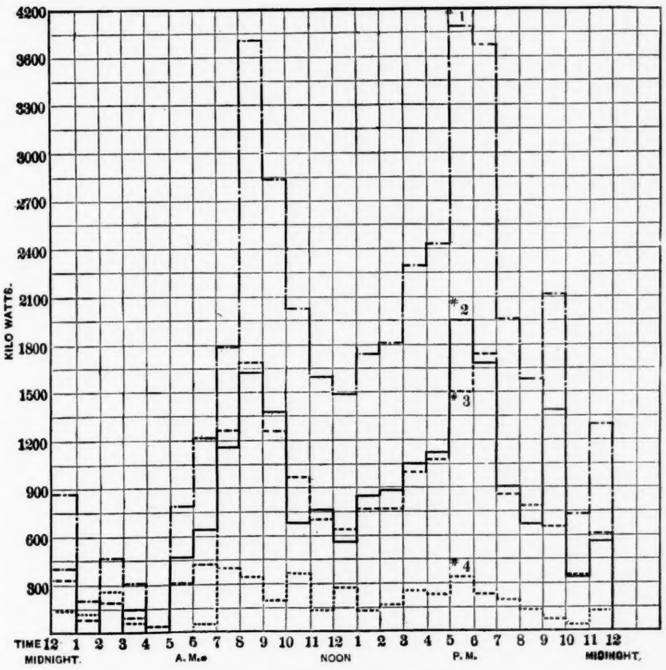


Fig. 3.

The purchase of both D. C. and A. C. energy was considered on the lowest basis that it was thought possible for any existing company to furnish it, and it was found that the D. C. energy would cost the railroad company one-half cent more per k.w. hour than the A. C. energy, in consequence of the interest, depreciation, maintenance, etc., of the transmission lines, rotary converters and other sub-station apparatus which would have to be furnished by the energy producing company. The prohibitive annual cost of these purchasing plans is at once observed by reference to Columns VI. and II., the plans only meriting consideration as representing a temporary arrangement that might be effected in order to allow rapid installation.

Owing to the more or less complex system of overhead or third rail yard construction made necessary by the nature of the case, and the advantages to be obtained by their elimination in the substitution of locomotives which could, for switching service, be self contained, though normally supplied with energy from the working conductors, a study was made of electric locomotives carrying batteries. The results of these studies made under several different assumptions are shown under Plans 9, 10 and 11. From Columns VI. and III. it is evident that whatever may be gained by the elimination of the overhead construction is largely offset by the additional cost of operation, although it will be observed that the cost per locomotive mile of Plan 9 compares favorably with the cost of Plan 12.

Plan 12 differed only from Plan 5 in a slight reduction in the capacity of the converting apparatus in the power house and sub-stations and the substitution therefor of two storage batteries (one located in or near the power house and one in the sub-station) each of such capacity that it, together with only a portion of the main station and sub-station machinery, would be capable of taking over the entire load of the line for a short period of time in cases of emergency.

The additional first cost and the slight increase in annual expense (as compared with Plan 5) represented by a reserve station capacity of this nature, was thought to be of secondary importance only, in view of the increased reliability of operation thereby obtained. The increased cost of operation in this plan over that of Plan 5 is due to the fact that the battery maintenance was figured at 10 per cent. per annum, which is considerably higher than is ordinarily assumed, and will probably be considered excessive by some.

A battery of this kind would not only serve as a reserve but would prove of considerable value as a regulator of potential along the line, and in addition it would, notwithstanding its inherent losses, tend to reduce the power house operating costs by taking up the excessive load fluctuations of the system and permitting the load upon the engines to be maintained at or near their most efficient working capacity.

It was considered of the utmost importance in an installation of this magnitude that the number of interruptions of power supply be reduced to a minimum, that no device which could increase the safety and reliability of the plant should be omitted, and that the probability of future extensions of the electrical system should be considered. As best fulfilling the above conditions, therefore, *Plan 12 was the one specifically recommended for adoption.*

Operating Expenses.—A careful compilation of all the expenses entering into the operation of the present steam service was made and the following comparative table (Table II.) of relative costs is believed to be correct, assuming that the present locomotives running between Mott Haven Junction and Grand Central Station should be abandoned and the service now performed by them duplicated by electric locomotives operated in accordance with Plan 12. It is assumed that the electric locomotives will be operated by the same class of men as those who now operate the steam locomotives and that they would receive the same rate of pay that they now receive.

This condition is not favorable to electric traction as it is not ordinarily necessary to have two men to operate an electric motor, but in the writer's judgment, it is not advisable to operate a service of this class under such exacting conditions without two men on each locomotive.

If the motor car system should be adopted, as it probably would be were the electrical equipment extended beyond Mott Haven Junction, or if the forward guard or brakeman were allowed to take the place of the second man while passing through the tunnel and yards, a saving equivalent to his wages could thereby be effected.

With two men of the same skill as at present employed on the locomotives, the figures are as follows:

Table II.

	Steam.	Electricity.
Operating expenses per locomotive mile exclusive of fixed charges, but including water, labor, cost of cleaning and repairing tunnel, and all other expenses of locomotive operation	23.05	15.80
Fixed charges per locomotive mile assuming that it now requires 40 locomotives to perform the present service and that 33 electric locomotives could perform the same service.	1.13	7.83
Total in cents	24.18	23.63

From these figures it appears that while there would be a slight annual saving in operating expenses in favor of electricity, it is not sufficient to warrant its adoption on the grounds of economy in operation alone, although its adoption can be justified on other grounds.

These figures could be made more favorable to electricity were an optimistic view of many of its advantages taken, and the probability is that practical operation will show a somewhat greater gain than here indicated, but it has been deemed best by the writer to maintain a conservative view throughout the entire investigation.

It is, however, safe to conclude that the saving in operation expenses by the electric system would be sufficient to offset the increased fixed charges due to the additional investment made necessary by its adoption.

TABLE I.—TABLE OF ESTIMATES ON PLANS FOR PROPOSED ELECTRICAL EQUIPMENT OF THE N. Y. C. & H. R. R. R. BETWEEN GRAND CENTRAL STATION AND MOTT HAVEN JUNCTION.

Plan. Character of Stations, Etc.	I. Operating expenses per K.W. hr. at power house switchboard.	II. Operating expenses per K.W. hr. at contact shoe.	III. Cost per K. W. hr. delivered to motor terminals exclusive of fixed and operating charges on electric locomotives.	IV. Operating expenses per electric locomotive mile.	V. Fixed charges per electric locomotive mile.	VI. Total cost per electric locomotive mile.
1. Direct current power station at center of line and contiguous to tracks, 600 volt working conductor, no batteries	.447c	.60c	1.06c	14.02c	6.58c	20.60c
2. Same as No. 1, with batteries in power house	.472	.66	1.137	14.65	6.71	21.36
3. Same as No. 1, with battery sub-station near Grand Central Station and Mott Haven Junction	.475	.668	1.20	14.7	7.25	21.95
4. Alternating current power station on river front near center of line, with rotary converter sub-stations near each end of line. 11,000 volt A. C. and 600 volt D. C.	.572	.715	1.287	15.2	7.58	22.78
5. Combined D. C. and A. C. power station at Harlem River near one end of line and one rotary converter sub-station near the other end of line. 11,000 volt A. C., 600 volt D. C., no batteries	.570	.666	1.19	14.7	7.18	21.88
6. Direct current feeders from Manhattan Railway sub-station located near center of line. Transmission from sub-station to working conductor, 600 volts D. C. energy to be purchased	2.5	2.650	2.748	34.64	2.89	37.53
7. Rotary converter sub-station at center of line. A. C. energy to be purchased from Manhattan sub-station and transmitted at 11,000 volts. Energy to cost ½ cent less per k.w. hour than D. C. energy delivered	2.5	2.336	2.508	31.50	4.23	35.73
8. Two rotary converter sub-stations, one near each end of line. A. C. current to be purchased from Manhattan sub-station near center of line	2.1	2.336	2.504	31.50	3.93	35.43
9. Combined A. C. and D. C. power station near Harlem River at end of line. One sub-station near other end, and batteries carried on locomotives charged from working conductor	.519	.629	1.122	16.58	7.76	24.34
10. One rotary converter sub-station near center of line, A. C. current purchased from Manhattan sub-station No. 7, batteries on locomotives charged from working conductor	2.12	2.4	2.502	34.40	4.08	38.48
11. Direct current feeders from Manhattan sub-station No. 7, near center of line. Batteries on locomotives charged from working conductors	2.5	2.738	2.742	37.81	2.51	40.32
12. Combined A. C. and D. C. power station at Harlem River near outer end of line. One sub-station near the other end. Batteries in power station and sub-station. A. C. transmission 11,000 volts, D. C. conductors 600 volts	.55	.775	1.335	15.80	7.83	23.63

The Isthmian Canal.

The Senate has passed the Spooner bill, providing for the construction of the Isthmian canal, by a comfortable majority. Whether or not this bill will be accepted by the House and become a law in the present session we cannot judge from facts that have come to light at the time of writing. The essential points of the Spooner bill are as follows:

The President is authorized to acquire, at a cost not exceeding $40,000,000, all of the rights, right of way, unfinished work and other property owned by the New Panama Canal Company of France on the Isthmus of Panama, and all its maps, plans, drawings, records, on the Isthmus of Panama and in Paris, including all the capital stock, not less, however, than 68,863 shares of the Panama Railroad Company, owned by or held for the use of said canal company, provided a satisfactory title to all of said property can be obtained.

The President is authorized to acquire from the Republic of Colombia upon such terms as he may deem reasonable, exclusive and perpetual control in perpetuity of a strip of land, the territory of the Republic of Colombia, not less than six miles in width, extending from the Caribbean Sea to the Pacific Ocean. The President may acquire such additional territory and rights from Colombia as in his judgment will facilitate the general purpose hereof.

The President shall cause to be constructed a ship canal from the Caribbean Sea to the Pacific Ocean and he shall also cause to be constructed such safe and commodious harbors at the terminal of said canal, and make such provisions for defence as may be necessary for the safety and protection of said canal and harbors; the President is authorized for the purposes aforesaid to employ such persons as he may deem necessary and to fix their compensation.

Should the President be unable to obtain for the

United States a satisfactory title to the property of the New Panama Canal Company and the control of the necessary territory of the Republic of Colombia and the rights mentioned in Sections 1 and 2 of this act, within a reasonable time and upon reasonable terms, then the President, having first obtained for the United States exclusive and perpetual control, by treaty, of the necessary territory from Costa Rica and Nicaragua, upon terms which he may consider reasonable, for the construction, perpetual maintenance, operation and protection of a canal, shall cause to be constructed a ship canal from a point on the shore of the Caribbean Sea near Greytown, by way of Lake Nicaragua, to a point near Brito, on the Pacific Ocean. The sum of $10,000,000 is appropriated toward the project contemplated by either route so selected.

And the President is authorized to cause to be entered into such contract as may be deemed necessary. Appropriations therefor shall from time to time be hereafter made, not to exceed in the aggregate the additional sum of $135,000,000, should the Panama route by adopted, or $180,000,000 should the Nicaragua route be adopted.

To enable the President to construct the canal there is created the Isthmian Canal Commission, to be composed of seven members, who shall be nominated and appointed by the President by and with the advice and consent of the Senate, and who shall serve during the pleasure of the President and one of whom shall be named as the Chairman of said commission.

Of the seven members of said commission, at least four shall be persons learned and skilled in the practice of engineering, and of the four at least one shall be an officer of the United States Army and at least one other shall be an officer of the United States Navy, the said officers respectively being either upon the active or retired list of the army or of the navy. Said commissioners shall each receive such compensation as the President shall prescribe until the same shall have been otherwise fixed by Congress. In addition to the members of said Isthmian Canal Commission, the President is hereby authorized, through said commission, to employ in said service any of the engineers of the United States Army at his discretion and likewise to employ any engineers in civil life, at his discretion, and any other persons necessary for the proper and expeditious prosecution of said work. The compensation of all such engineers and other persons employed under this act shall be fixed by said commission, subject to the approval of the President.

The Chicago & Alton Shops at Bloomington, Ill.

When the Chicago & Alton shops were rebuilt after the fire which destroyed all the wooden buildings some 30 or 35 years ago, the new shops which were completed in 1883 were considered as fine a plant of the kind as could be found anywhere in the country. But the increased size of cars and motive power of to-day had rendered the facilities entirely inadequate for handling them and an almost entirely new equipment became necessary. The work undertaken in connection with the remodeling of the Bloomington shops was quite extensive, providing as it did for a thorough modernizing of the shops, tools and machinery. Every effort was made to provide the most economical appliances and the estimated cost of the work as originally planned was some $350,000. The actual expenditure has exceeded this considerably.

The improvements made are of especial interest as they indicate methods of extending existing structures at comparatively little expense, for the accommodation of modern railroad equipment. The principal buildings of the old plant being of stone, it was desirable to use them, and but two entirely new buildings have been erected. The paint shop and passenger car shop have been widened 18 ft. each; the transfer tables were lengthened from 60 to 70 ft. and the roundhouse enlarged and supplied with a 65-ft. turntable. Of the two new buildings, one is a power house, 135 x 75 ft., and the other a wheel and axle shop, 119 x 75 ft. The wheel and axle shop forms part of what is to be a large freight car shop, only the west end of which is built now. The plans provide for a length of 263 ft. when completed. This building has a very high roof with a large number of ventilators and skylights. The roof is slate, supported on composite steel and wood trusses, the compression members being of the latter material. At the end to be used for machinery the bottom chords are made sufficiently strong to support the shafting.

The general layout of the plant in the accompanying engraving shows the location and relation of the various buildings. The new structures and extensions of old ones are indicated by the shaded portions. The buildings of stone having slate roofs are briefly as follows: The passenger car shop, having a track capacity for 12 cars. The paint shop, a duplicate of the passenger car shop as regards dimensions and track capacity, and having the varnish room at the east end and upholstery room at its west end. The planing mill and cabinet shop, a two-story building, 200 x 75 ft., having the latter department on the second floor; the southwest corner of this floor is occupied by the plating and brass buffing department. Adjoining this building is the pattern shop, 53 x 28 ft. The foundry, 180 x 60 ft., having an ell extension 109 x 40 ft., the main room being the iron foundry, and the ell the brass foundry and casting room; a pattern storehouse north of the foundry is 90 x 40 ft. and two stories high. The machine and erecting shop is divided in the center by the columns supporting the crane runways, the north side being the machine shop and the south side the erecting floor, having room for 18 locomotives. The blacksmith shop, adjoining the machine and erecting shop on the north. The north roundhouse, enlarged as shown, to accommodate the large locomotives and equipped with a new 65-ft. turntable, electrically driven. The old roundhouse, occupied by the tin and tank shops, and also a small shop for light repairs to small locomotives. The boiler shop, to which was added a riveting tower. The general storehouse having a second story which is occupied by the officers of the road and transportation departments.

New coaling and ash-handling facilities were provided, the former being one of the Link-Belt Machinery Co.'s coaling stations. The Chicago & Alton has had its line equipped with 10 such stations, comprising two types, terminal and main-line, a full description of which may be found in the *Railroad Gazette* of March 14. The Bloomington station is of the terminal type. The ashes are handled by compressed air. The engines are cleaned over a pit in which run small cars, having clam-shell bodies. These cars are lifted out of the pit by a pneumatic hoist and are dumped into a railroad car on an adjacent track.

Power Station.—In the old arrangement of the shops the locomotive and car departments had each a large stationary engine for power, besides a number of auxiliary engines for each department. The steam for these engines was generated at four different boiler plants, each having its force of engineman, fireman and helpers. This arrangement has been supplanted by a large central station, furnishing electric light and power to the shops, shop yards and railroad yards. The building is brick 135 x 75 ft., having a slate roof on steel trusses, with necessary skylights and ventilators. A brick wall running longitudinally through the center of the building separates the engine and boiler rooms.

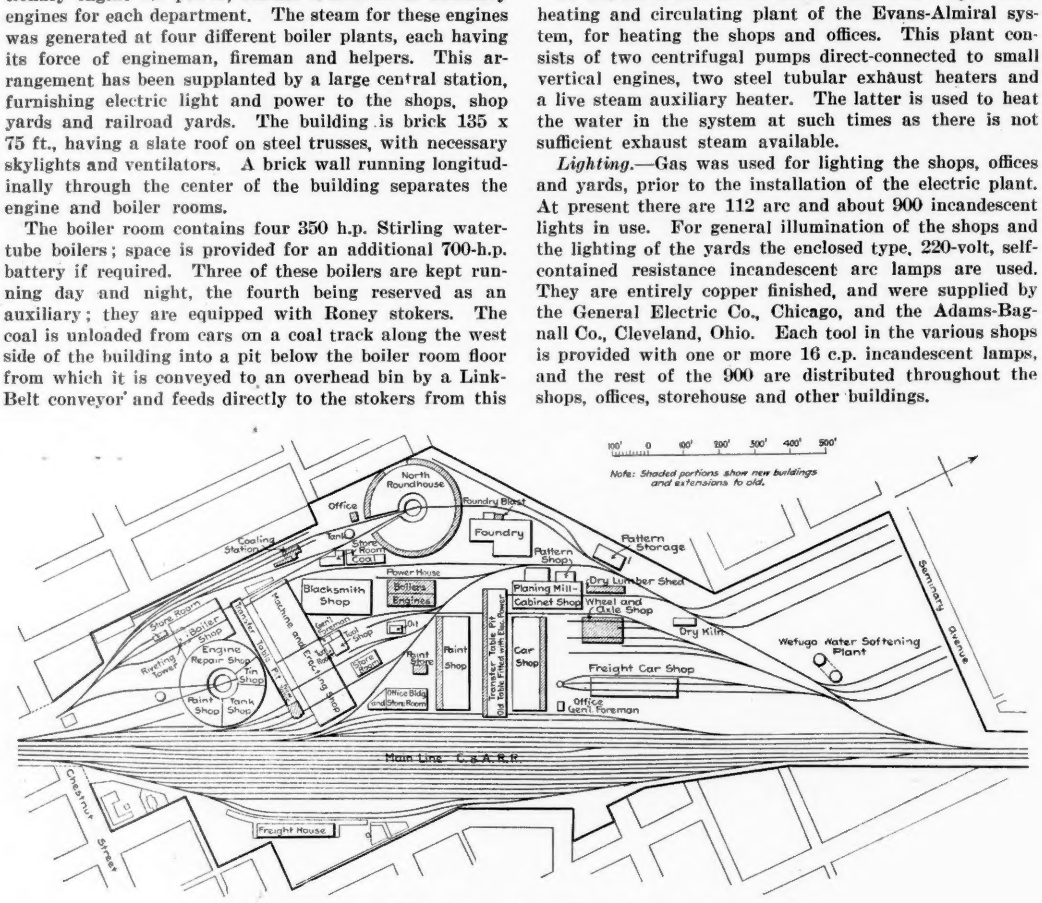
The boiler room contains four 350 h.p. Stirling water-tube boilers; space is provided for an additional 700-h.p. battery if required. Three of these boilers are kept running day and night, the fourth being reserved as an auxiliary; they are equipped with Roney stokers. The coal is unloaded from cars on a coal track along the west side of the building into a pit below the boiler room floor from which it is conveyed to an overhead bin by a Link-Belt conveyor and feeds directly to the stokers from this

A convenient arrangement by which the large gate valves between the boilers and the live-steam header may be closed from the engine room floor is being put in. The hand-wheel of the valve is removed and a sprocket-wheel of suitable dimensions substituted. A Link-Belt chain passes from the sprocket through the wall and over guide pulleys down to a second sprocket near the floor. By simply turning a crank on the shaft of this latter sprocket the valve may be opened or closed at will. The crank is removable and may be used for any valve. Provision is made for keeping the chain tight.

The exhaust header runs under the floor along the east side of the dividing wall and leads through a large Cochrane feed-water heater and two large tanks, forming a part of the heating system, and then to a free exhaust pipe through the roof. A by-pass exhaust pipe through the roof enables the heater to be shut off in case of repairs. The feed-water, which comes from the company's own pumping station, is run into a tank placed against the east wall of the boiler room. From this tank it passes into the heater and purifier from which it is pumped into the boilers. A reserve pump is connected to the city water line and is used only in case the water from the company's pumping station runs short.

In the south end of the boiler room is a large water-heating and circulating plant of the Evans-Almiral system, for heating the shops and offices. This plant consists of two centrifugal pumps direct-connected to small vertical engines, two steel tubular exhaust heaters and a live steam auxiliary heater. The latter is used to heat the water in the system at such times as there is not sufficient exhaust steam available.

Lighting.—Gas was used for lighting the shops, offices and yards, prior to the installation of the electric plant. At present there are 112 arc and about 900 incandescent lights in use. For general illumination of the shops and the lighting of the yards the enclosed type, 220-volt, self-contained resistance incandescent arc lamps are used. They are entirely copper finished, and were supplied by the General Electric Co., Chicago, and the Adams-Bagnall Co., Cleveland, Ohio. Each tool in the various shops is provided with one or more 16 c.p. incandescent lamps, and the rest of the 900 are distributed throughout the shops, offices, storehouse and other buildings.



General Layout of Chicago & Alton Shops at Bloomington, Ill.

bin. The same conveyor carries the ashes to an overhead storage bin from which they may be loaded by gravity into a car. The smokestack is steel, 8 ft. in diameter by 175 ft. high, and lined with fire-brick for three-fourths of its height.

The live-steam header is supported upon brackets secured to the dividing wall, and the connections to it from each boiler are in the form of an inverted U. Long-sweep bends of 5-in. pipe carry the steam through the wall to the engines. All steam and exhaust piping is lagged with Philip Carey Manufacturing Co.'s No. 1 magnesia covering.

The engine room contains three 300 h.p. cross-compound engines, each direct-connected to a 200-k.w. direct-current, multipolar generator, and one 160-h.p. tandem-compound engine direct-connected to a 110-k.w. generator. The engines were built by the Buckeye Engine Co., Salem, Ohio, and the generators by the Milwaukee Electric Co., Milwaukee, Wis. Space has been left for one 300-h.p. unit to be added at some future time. The generators are designed for a 250-volt circuit and are connected in parallel. The seven-panel switchboard, furnished by Kohler Bros., Chicago, is of white Italian marble and is mounted with Weston instruments, and I. T. E. circuit-breakers on the heavy feeder circuits; besides these there is a Bristol recording voltmeter. At the south end of the engine room is the hydraulic plant for furnishing power to the hydraulic riveter in the boiler shop. This plant consists of an accumulator, receiver and pump built by the Barr Pumping Engine Co., Philadelphia, Pa. In line with the generator units are two air compressors, built by the Norwalk Iron Works Co., South Norwalk, Conn., each having a capacity of 300 cu. ft. of free air per minute. Running the entire length of the engine room is a 7-ton hand-power traveling crane. The room is lined to a height of 6 ft. with white enameled brick capped with a line of dark-brown enameled brick, making a very handsome appearance and enabling the walls to be kept much cleaner than would be possible with common brick. The floor is laid with cement.

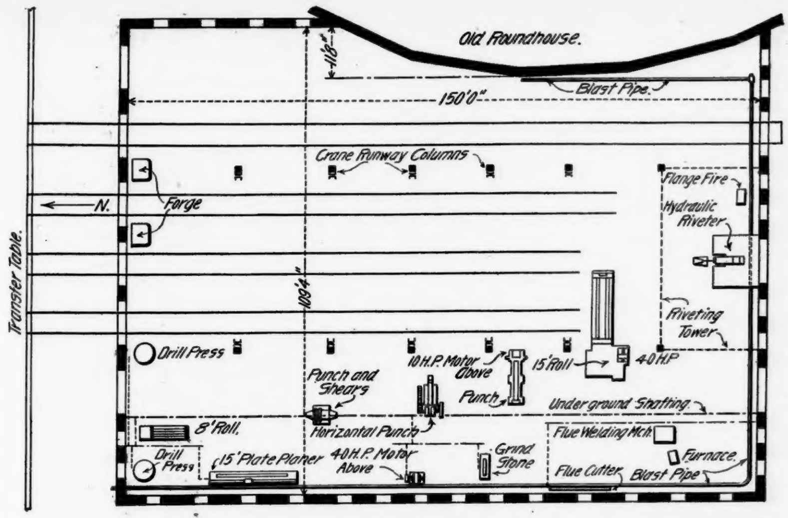
Machine and Erecting Shop.—This building is 408 ft. long by 114 ft. wide, and, as has already been mentioned, is divided in the center by the columns supporting the crane runways. The old facilities of this shop included two rope-driven traveling cranes having a capacity of 22½ tons each. They have been replaced by two 50-ton electric cranes built by the Case Manufacturing Co., Columbus, Ohio, each having two carriages; also one carriage on each crane has a small drum for light lifting. The old runways were removed and new ones suitable for the increased power were substituted. On the machine-shop side two hand-power traveling cranes have been replaced by electric cranes.

The machine tools, formerly distributed without much regard for system and driven from shafting belted to a large stationary engine, have been rearranged in groups according to the class of work, and are driven by electric motors; all of the larger tools, such as wheel lathes, planers, etc., are driven by independent motors. Many of the old tools have been replaced by larger, up-to-date machines. The vise benches, formerly located along the north wall and running the entire length of the shop, have been grouped at the east end of the shop. Over these benches a small electric traveling crane is to be placed.

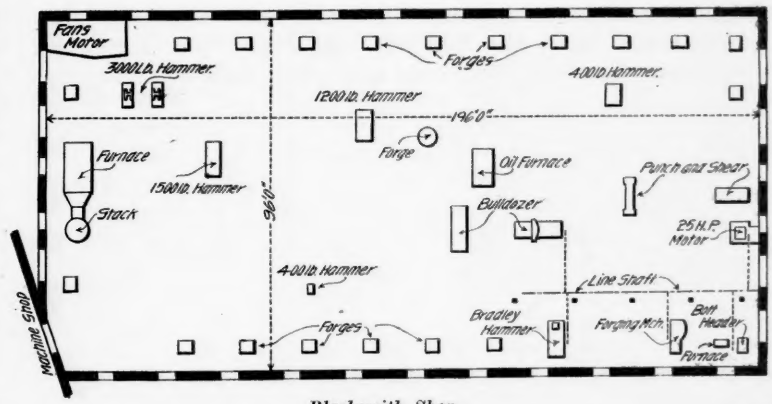
On the north side of the machine shop and near the center is the tool room, 30 x 20 ft. In connection with this is a tool shop, 38 x 40 ft., equipped with all of the necessary appliances for making small machine tools. This equipment includes two wheel lathes, a milling machine, shaper, universal grinding machine and a patent tool grinder, all driven by shafting and belts from a 10-h.p. motor.

Over the east end of the machine and erecting shop are the offices of the Superintendent of Motive Power and Mechanical Engineer, and the drafting room, 47 x 46 ft. The Master Mechanic's and General Foreman's offices occupy the room formerly used as an engine room, located near the center of, and adjoining the machine shop.

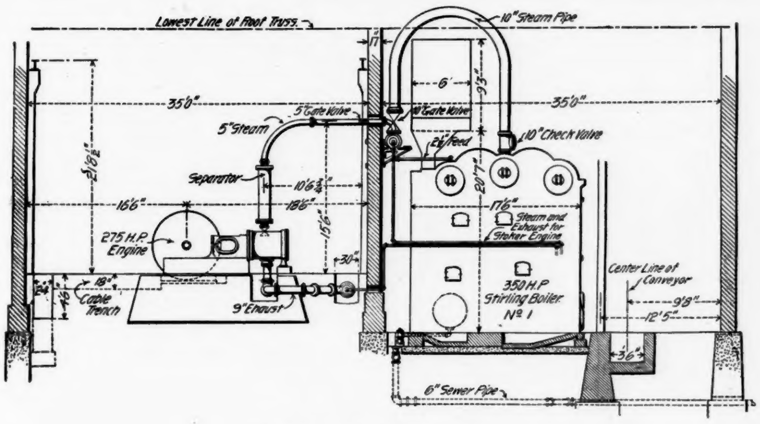
Blacksmith Shop.—The blacksmith shop, which adjoins



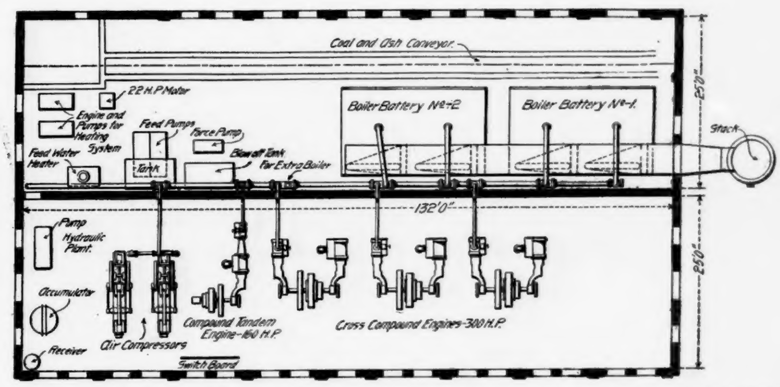
Boiler Shop.



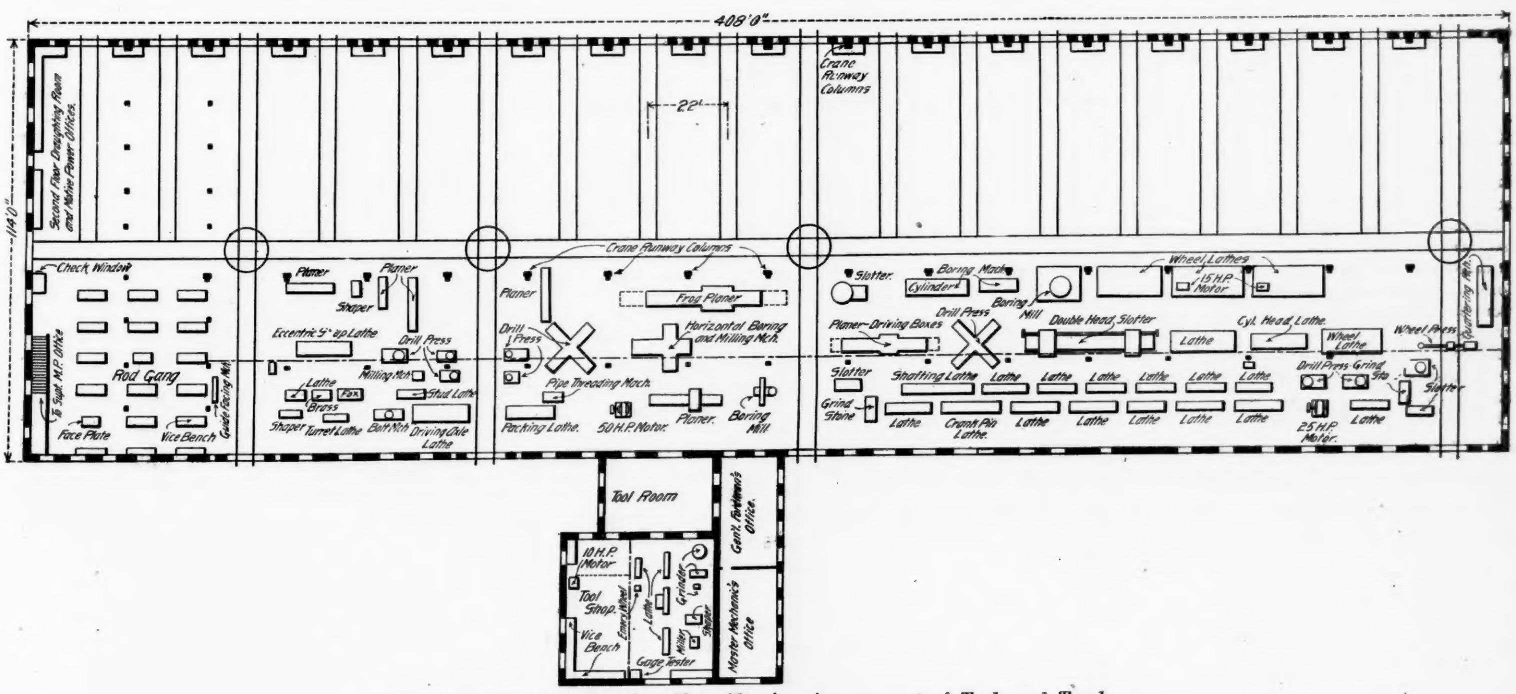
Blacksmith Shop.



Engine and Boiler Rooms.



Plan of Power Station.



Plan of Machine and Erecting Shop Showing Arrangement of Tools and Track.

The Chicago & Alton Railway Company's Shops at Bloomington, Ill.

the machine shop and extends to the north, is 200 x 100 ft. The old machinery in this building was replaced by modern equipment, including steam and power hammers, furnaces, forges, bottle machines, bulldozers, etc. The small machines have been grouped and are driven by belts from line-shafting, and the larger tools, such as punches, shears, etc., have independent motors. All of the steam hammers have solid concrete foundations made of one part of Portland cement, two of sand and four of crushed stone. They were built by the J. W. Evans Sons Co., of Bloomington, who were the contractors for all the machine foundations built. A large wooden building west of the shop is used for storing the material.

Boiler Shop.—The boiler shop, 125 x 112 ft., has been entirely remodeled and rearranged. The roof trusses were raised to make room for a 25-ton traveling crane and a large riveting tower was added containing a 25-ton riveting crane having a 50-ft. lift. As a general thing a riveting tower derives some of its support from the building, but in this case it is an independent structure. It is built of steel and is covered with 1-in. matched, grooved yellow pine sheathing outside of which is corrugated iron; the sheathing is for the purpose of protecting the iron from the gases of the shop. A 17-ft. hydraulic riveter was installed. Other new equipment includes a set of 14-ft. bending rolls, independently driven by a 40-h.p. motor, and built by the Niles Tool Works, Hamilton, Ohio; also a large motor-driven punch and shears from the Long & Allstatter Co., Hamilton, Ohio.

Planing Mill.—The rearrangement of this shop has not been begun yet. The plans for its revision are in keeping with the work already done. Modern tools, electrically driven, will be added, and an electric elevator is to be put in between the first and second floors. A large lumber shed, 126 x 20 ft., of wood, with gravel roof and having sliding doors along the front, has already been built just north of the mill.

Wheel and Axle Shop.—This is an entirely new building, of brick, 75 ft. long by 119 ft. wide. As has already been mentioned, this structure forms one end of what is at some future time to be a freight car shop 260 ft. long, and having an ell extension 240 x 50 ft. This ell is to be equipped for repairing steel cars and will be provided with traveling cranes and all other facilities requisite for the repairs of these cars. The present building is equipped for finishing wheels and axles and erecting freight car trucks. All tools are motor-driven from line shafting. The tracks and turn-tables in connection with the building and between it and the planing mill, passenger car shop and material yard have been arranged with a view to facilitating the handling of material between these places.

Tin and Tank Shop.—When the north roundhouse was enlarged the small house south of the machine and erecting shop was no longer needed as an engine house. The pits were covered, new floors put in and a heating system installed. The building was divided then into quadrants. In one of these is the tin shop, formerly located in the building now occupied by the general store room. In another is the tank repair shop, and adjoining this is the tank and cab paint shop. The remaining portion of the building is used for light repairs to small locomotives.

Roundhouse.—This building was practically rebuilt. The outside wall was taken down and moved 17 ft. further out to make room for the large locomotives. The pits were extended 14 ft. 3 in. and the space from wall to wall is now 75 ft. New smoke-jacks were put in, tracks and floors relaid and a heating system introduced; pneumatically-equipped drop-pits were added and the facilities for boiler washing and for making minor repairs to engines were greatly improved. The turn-table has been enlarged to 65 ft. and is driven by a $7\frac{1}{2}$ h.p. electric motor.

Transfer Tables.—Running between the paint and car shops is a transfer-table pit 360 ft. long and 70 ft. wide,

The table was built by George P. Nichols & Bro., Chicago, and has a capacity of 75 tons. It is operated by a 25-h.p. street railway motor built by the Milwaukee Electric Co., which receives current from a double trolley line running in a cast-iron trench in the center of the pit. Under full load the table travels 175 ft. per minute, and 300 ft. per minute when light. The two speeds are obtained by means of friction clutches and two separate gears. Another set of clutches operates a winding drum, for drawing cars onto the table, at a speed of about 125 ft. per minute. The locomotive transfer table is practically a duplicate of the other, except that the capacity is 100 tons.

A large Wefugo water softening plant is located in the north end of the yard. The settling tanks have a capacity of 90,000 gal. each, and all locomotives and stationary boilers are supplied with the treated water.

Arrangements are being made to run an 8-in. pipe line the entire length of the property for protection against fire. The main will be connected to the city mains and will have 11 Corey patent 5-in. valve, 7-in. stand-pipe fire hydrants, suitable for connection to the city fire equipment. Proper provision will also be made in the various buildings for added protection against fire.

We are indebted to Mr. A. L. Humphrey, Superintendent of Motive Power, and to Mr. J. F. Johnson, Acting Mechanical Engineer, for information and drawings.

The M. C. B. Convention.

The thirty-sixth annual convention of the Master Car Builders' Association met in the ball room of the Grand Union Hotel, Saratoga Springs, N. Y., on Wednesday, June 18. The meeting was called to order at 10:15 a.m. by President Hennessey. An address of welcome was delivered by Mayor Knapp, to which Mr. A. M. Waitt, of the New York Central, responded. The president then read his annual address, which follows in part:

PRESIDENT'S ADDRESS.

In the matter of establishment of rules, whereby the vast interchange of traffic in this country is safely and expeditiously handled, the Master Car Builders' Association has performed a work of inestimable value to the railroads and the business interests of the country. As to the ease with which it is handled, if you will refer to the report of your Arbitration Committee, you will find that it has been necessary to decide but 19 disputes during the past year, four of which originated under your present rules. The changes which your committee proposes this year are minor in character, and are intended in the main to clear up a few mooted questions. It will also be seen by reference to the same report, that the rules are practically satisfactory to all sections of the country except the Middle West, where an immense traffic is handled in a congested district.

The first provision of the constitution, namely—Construction, Repairs and especially Uniformity—is the large field to which this Association now has to devote its energies, and herein lies the future usefulness of the Association. Already, some progress has been made in this direction, but much more remains to be done. Heretofore we have devoted a great deal of time to the revision of the Rules of Interchange, but the rules are now in such shape that the work of revision has dwindled until now not more than two or three hours are necessary to dispose of the matter. The future of this Association is what we make of it. It will not do to look backward and pride ourselves over our glorious past record, but we should strive to be up and doing, and by our earnest and untiring efforts, surmount the difficulties which are strewn in the pathway of progress and bring about the speedy and wise solution of the problems now confronting us.

This Association has adopted standards for the different parts of cars—some of which are wholly lived up to, some partially, while others are not used at all. We should devise some means for a more strict enforcement of the existing standards. If there are any unworthy of adoption, let such standards be stricken from the lists of the Association.

Under our present organization, a private line company, to become a member of the Association, must own over 1,000 cars, and then they are entitled to only active membership, which allows them but one vote, and for which they pay dues accordingly. Under the provision of the Rules of Interchange, any private car line, however small, may become a subscriber to the rules, and be entitled to all the privileges which go with it. A railroad company, to become a subscriber to the Rules of Interchange, must have a representative member in the Association. I would recommend that private line companies be placed on the same footing as railroad companies in so far as representative membership is concerned. This would give some of the larger private line companies more than one vote in the Association, but at the same time they would have to pay dues in proportion to the number of cars represented. If the constitution was so modified, then the Rules of Interchange could be altered to require all private car lines wishing to become subscribers to the Rules of Interchange to have a representative member in the Association.

Since the assignment of committees at the first meeting of your Executive Committee last fall, three other committees have been added to the list as follows:

The *Railroad Gazette* advised under date of Jan. 2, 1902, that it was ready to publish a new and up-to-date edition of the Master Car Builders' Dictionary, and asked for a committee to supervise the work of preparation, as has been done on similar occasions in the past. A committee consisting of Messrs. A. M. Waitt, J. S. Lentz and W. P. Appleyard was named.

Early last fall, advice was received from the American Railway Association, of the adoption by that association of a standard box car, with the request that this Association consider and adopt the required external dimensions for the standard box car. A committee was immediately named, consisting of Messrs. C. A. Schroyer, G. W. Rhodes, W. P. Appleyard, J. N. Barr and Joseph Buker.

The Committee on Standard Pipe Fittings was revived during the year, to receive the report of the American Society of Mechanical Engineers, on the subject of standard pipe unions.

I desire to call the attention of all the members to the fact that the M. C. B. repair card is not being applied to foreign cars in all instances where repairs are made; neither are the repair card stubs being received by car owner in all cases where no bill is rendered. This, I presume, is attributed to the repairer's inadvertence, rather than to his wilful omission. I desire to impress upon all members the importance of seeing to it that the repair card is applied to a foreign car in every instance of repairs, and that the repair card stub be forwarded to car owner, in accordance with Section 14 of Rule 4. I would therefore urge that, upon return to your respective places of business, you issue such instructions as will cause repairers to comply with this very important requirement.

On account of the extended use of metal cars, and cars with metal underframing, I would suggest that a committee be appointed to report at the next convention designs for standard metal cars of the different classes, as well as standard metal underframing for the various classes of cars, with a view of making the parts as accessible for repair as possible.

Your Committee on Draft Gear has probably given more time to the questions assigned it, than has any of the other committees—and this is said without any desire to belittle the work of the other committees; but at the last convention this committee was given wide latitude and definite instructions to go into the matter very thoroughly. This has been done, and the results of drop tests at Altoona, and the compression and tensile tests at Lafayette, together with the recommendations of the committee after careful consideration of the data obtained from the tests, are presented to you in complete detail and should be thoroughly considered.

To provide for the needs of the present day equipment, and yet take care of the ever increasing demand for larger and heavier equipment, is a problem that has demanded the best thought of those in charge of the car department. Were we satisfied that the maximum capacity of cars had been reached, the problems would be easy of solution, as we could then base our calculations on present maximum capacities and weights. But I do not believe the limit has been reached; traffic demands will probably require the construction of certain classes of cars of much greater carrying capacity. To meet this demand when it is presented, and at the same time take care of the present conditions, is the new work we now have in hand. We are at present in a transitory period from cars of 60,000 lbs. capacity to cars of 100,000 lbs. capacity. We are considering at this convention, draft gear, cast-iron wheels, couplers, bearings, center plates, etc., having in mind cars of 100,000 lbs. capacity. If we believe that still larger capacity cars will be required in a short period, had we not better commence to plan the meeting of that demand when it presents itself?

As stated before, one of the former features of the usefulness of this Association, viz.: Revision of Rules of Interchange has become secondary in character, leaving a greater share of our time for the attention to other matters, and if we wish to maintain this Association as a useful adjunct to railroad work, we must devote our energies to getting closer together in car construction, and by the strict maintenance of uniform standards and the extended use of same, operate our department on the most economical basis. As the office of the Presidency of this Association is a position of honor, I would recommend that the precedent set by my immediate predecessor of one term only, be continued.

SECRETARY'S REPORT.

The total membership is 491, divided as follows: Active members, 275; representative members, 190; associate members, 8; life members, 18. There has been but a small increase in membership during the year, though numerous changes have taken place. There have been transferred from active to representative membership 11 members; nine new representatives from new roads and 22 new representatives from old roads have been added. The number of cars represented in the Association is 1,630,016, an increase of 124,394 cars during the year. During the year, 23 subscribers to the Rules of Interchange have been added, 11 of these being railroads and 12 private car companies.

The report of the treasurer, Mr. John Kirby, was then read. It showed a balance on hand of $9,165.85. The report was received and ordered spread upon the minutes and the treasurer's report was received and referred to the Auditing Committee.

The secretary read a report from the Executive Committee recommending that the dues be reduced from $4 per vote per year to $3 per vote per year, which was adopted.

The President appointed the following committees on obituaries, for A. M. Parent, H. M. Pflager; for E. C. Spalding, W. A. Love; for W. L. Hoffecker, William McIntosh; for H. L. Preston, C. A. Schroyer. As a Nominating Committee the President suggested the names of J. T. Chamberlain, J. S. Lentz and F. D. Adams. Committee on Correspondence and Resolutions, F. M. Whyte, F. H. Clark and A. W. Gibbs.

Messrs. William McWood, P. H. Peck and T. A. Lawee were elected members of the Auditing Committee.

Article 3 of the constitution was amended by the addition of the following as Section 5:

"Members of this Association, either active or representative, who have been in good standing 25 years may become candidates for life membership on the recommendation of the executive committee. The names of such members shall be referred to the Association in convention for election by ballot at any regular meeting of the Association and five dissenting votes shall reject."

Section 5 as it is now was changed to Section 6.

PER DIEM.

Mr. A. M. Waitt (N. Y. C.)—In reading over the report of the Arbitration Committee, I notice, so far as the printed report shows, there is no provision as to modifications that will be necessary in the rules to make them harmonize with the new per diem system of handling cars. I think it would be well for a formal vote to be passed by the Convention asking the Arbitration Committee to take that into consideration and present such suggestions as may seem proper to them, to cover the case. Possibly they contemplated doing it but if not I think it would be well to have a motion of that kind go before them.

Mr. P. H. Peck (Chicago Junction—I would state for the information of the Convention that the Arbitration Committee will meet to-night and that matter with others will be considered.

President Hennessey—The Secretary has some correspondence in regard to that subject which will be presented to the Arbitration Committee this evening.

A committee of three, consisting of J. E. Simons, A. M. Waitt and F. H. Stark, was appointed to consider the recommendations in the address of the President and report to the convention.

On motion, the report of the Committee on Standards and Recommended Practice was submitted to letter ballot. [See the *Railroad Gazette*, June 20, p. 456.]

TOPICAL DISCUSSIONS.

Advisability of Using Metal Center Sills in Wooden Car Construction.

Mr. R. P. C. Sanderson (Seaboard Air Line)—Mr. President and gentlemen, I believe the use of steel or iron center sills alone in connection with wooden center sills trussed or otherwise, is a mistake. In the proceedings of 1896, I think, will be found illustrated an arrangement of sills in a C., B. & Q. car that had been built a year or two before which shows a combination of steel sills in connection with wooden sills. I simply mention that to show that the matter has been figured on previously. In my opinion the main objection to the use of steel center sills in connection with the wooden intermediate and side sills trussed, is this; you have not only got to consider your carrying capacity but you have to consider your deflection. Assuming that you have two steel center sills, and it does not make any difference whether the steel is underneath in the shape of draft sills, running through from end to end, with wood on top or wood underneath and steel on top—as long as there are any steel sills in connection with the side and intermediate sills, the deflection of these sills, whether trussed or not, under load, is going to be radically different from the deflection of the wooden sills under the same load. Now assuming that you have a uniform load on the whole of the car floor, your steel sills, trussed, will deflect under their share of load to perhaps $^3/_{16}$ in. Your wooden sills put up to a camber of an inch will have the camber go clear out. You have a deflection there say of an inch. The tendency of the wooden sills trussed is to give way. The tendency of the steel sills is to stay there. The consequence is that the wooden sills will give way and throw an excessive load on the steel sills and sooner or later, with a repeated action of that kind, those steel sills will be overstrained, over-deflected, pass the elastic limit and finally break. I am strongly in favor, as a result of a great deal of study of this question, and some experimenting and designing and construction, of the use of entire metal underframing, properly constructed; but I do not think it is wise, for the reasons mentioned, to use a partial metal underframe.

Now it may be said that it is all right and has proved all right to use steel bolsters. That is true. But the steel bolster acts as a unit over its entire length. In the case of the steel sills, combined with wooden sills, they have all got to bear their share of the load and are acting together, and they do not act uniformly. Many a good constructor has failed, because the question of deflection under load has not been properly considered. It is not sufficient to consider strength only, but you must consider the deflection and the stress on the material under load and to see that those parts that have to act together are uniformly deflected and strained under the loads they have to carry, and if this feature is neglected, fracture is going to come sooner or later.

Mr. Charles Streicher (C. R. R. of N. J.)—I think Mr. Sanderson's explanation as to what will follow from a combination of wood and iron is well made. We do not have to go very far to find ample proof of this assertion. If you will recall, it is not many years ago that

the sandwich bolster under trucks was heralded all over the country as the best thing that could be placed under car equipment in the absence of steel construction at that time. In the repair shops it did not take very long to develop the fact that the sandwich bolster, the truck bolster as well as the body bolster is a failure, for the reason that the iron plates and the wood are two entirely different materials. The shrinkage is a great factor and we found many of the bolts passing crosswise through the bolsters were cut, and the pieces sandwiched in between the plates, particularly the outside plates or outside wooden pieces on trucks we found to be broken frequently, leaving practically nothing there to carry the load but the perpendicular plates. For this reason I think that any combination of wood and iron in car construction for any parts having to bear the load is a failure, and I do not see why at the present time we should make use of such constructive features. I think the time is passed for arguing which of the two materials, wood or steel, is preferable in car construction for such constructive details as longitudinal sills having to stand a hard service and excessive strain in modern high speed transportation. The center sills in wooden cars are giving us the most trouble in the interchange yards and the repair shops. Why should we not look for a more suitable material? In doing so, steel, pressed or rolled, will naturally be looked for; and the only question to be solved is the standard uniform section and the arranging of economical constructive features commending themselves to the parties required to take care of the damaged cars in the shops, at a minimum of expense.

Mr. L. T. Canfield (D., L. & W.)—I have had some experience in the last six or eight months with a semi-steel under-construction. It is not entirely a steel sill. I agree with Mr. Sanderson and also with Mr. Streicher that a steel center sill is not what we want. But I think Mr. Streicher made a good argument why we should make up a steel construction for receiving the buffing and tensile strain on the draft rigging. I think we can assemble standard rolled shapes so that they will deflect with the foundation or bottom of the car without injury to the draft attachment. We have now 1,100 cars running with an attachment whereby we use four steel draft timbers 8 ft. long that pass back through the transoms, and they are connected from transom to transom by one bar passing between the two, securely bolted behind the transom, to which the needle beams are added. They are of rolled section also. I think with this construction we shall take good care of the draft rigging, and also that it will accommodate itself to the deflection of the car without injury to the car. I do not think we ought to disturb the wooden sill construction of the car. I think it is as light as we should make it, and any steel added to it for the draft-rigging should be put underneath that.

Mr. Sanderson—I believe in modern heavy train service it is of the utmost importance for heavy cars that there should be a metal center sill or sills, as well as metal underframing. According to my experience, it is not the pulling strains of the engine which tear the cars in two; the damage is done by the shocks in service, and they are proportional to a great extent to the load carried by the car and the gross weight of the car. Now what you want to withstand that, is a strong steel construction that will stand the shocks without buckling in any direction. To use channels or I-beams, 36 to 40 ft. long, and not braced together sufficiently to form a column, will simply result in the I-beam being bent when the car receives the shocks which it is bound to get in service. If you put enough material in the steel center construction to make it strong enough to stand the service shocks, it becomes a backbone to the whole construction. If you get enough metal there to stand longitudinal strains and carry the load, it looks like good policy to take advantage of that and build on it, and save weight by utilizing its vertical strength as well as its longitudinal strength; but as I said before, I do not think you can use such construction successfully in connection with longitudinal wooden sills.

Mr. J. E. Simons (Pittsburgh Coal Co.)—I am opposed to the combination of wood and steel in car construction. In my experience in car construction I have never yet been able to find a piece of wood I could put in a car that would not shrink, and on the other hand, I can say I have never been able to find a piece of metal that I could bolt to a piece of wood that would not produce a moisture between the face of the metal and the wood, causing decay to take place after a certain time. I have watched with a great deal of interest the application of metal draft appliances to center sills, and I find that the action has taken place there that I have indicated, namely that there is a moisture between the two which we do not seem to be able to get rid of. Another feature is that we find in the continual buffing strain of the draft timbers that the bolts in the timber will wear holes longitudinally, and as the metal will not wear the parts become loose. You are troubled with a breakage of bolts and for this reason I have always been opposed to the application of metal and wood together for anything of that kind. I believe that we should have all steel. The time has gone by when the wooden draft timber should be used, and in the construction of new cars I shall certainly be a strong advocate of steel underframing.

Mr. Hayward (P. R. R.)—My views on the subject are that the rapid growth of the use of steel cars in general railroad service and the very general adoption of steel underframing with the improvements which have been made in this form of construction, make it hardly necessary to consider the use of a combination of wood and steel in the underframing of freight cars. I think the car of the future in this country is going to be the iron car, or one with iron underframing. The iron underframing has been in use in England and on the Continent for a number of years.

Meters for Stopping Leaks in Car Work Expenses.

This topic was to have been opened by Mr. G. W. Rhodes (B. & M. R.) Mr. Rhodes was absent, but sent a communication on the subject which the secretary read, and it is given below in part:

"A railroad company furnishes all its supplies without meters, and the wastes that occur are enormous. Let me cite a few cases that may be seen almost any day. What justifies a railroad company in allowing its locomotives to run with their headlights lit at one or two o'clock in the afternoon? Go to any union depot on a bright sunny day at two and three o'clock in the afternoon and it is not unusual to find headlights lit. Why? Simply because there is no meter.

"Take again the matter of lights in coaches. At our homes nobody thinks of lighting lamps an hour or two before it is dark, but there is hardly a railroad that does not have its lights lit while the sun is still shining. Recently in going east from Chicago the Pintsch gas was turned up in the sleeper in which I sat while in the depot, which was all right, as the depot was dark. As soon as we got out of town the sun was shining brightly, but the 24 burners in the car were all allowed to remain burning turned on full. No one would have thought of such extravagance anywhere excepting on a railroad.

"The remedy for this and similar wastes is a more general use of meters; the only meter that is practicable on a railroad is railroad accounts. Let us consider for a moment the question of car oil. A few years ago it was considered remarkably cheap with oil costing 20 cents per gallon to lubricate freight car equipment for 8 cents per 1,000 miles. The railroad official to-day who does not keep his cost of freight car oil down to an average of 4 to 6 cents per 1,000 miles is laying himself open to a great deal of criticism. A reduction in freight car lubrication, with oil at 20 cents per gallon, from 12 cents per 1,000 miles to 4 cents per 1,000 miles on a railroad of 4,000 miles extent, is the equivalent of a saving of $8,000 per year, a figure that is well worth the expense of an intelligent meter."

Mr. Hayward—I think the points brought up by Mr. Rhodes are very interesting and the economies he suggests for the benefit of the railroads should be carried out. Some of the roads, I think, go into these economies very extensively. For instance, the other day, I noticed a certain foreign road that follows up matters pretty closely wanted a card from us for the gas used in a private car used by officials of the road. Again, in picking up and saving material, I think it is very generally practiced on most roads; but sometimes a man's time, working in a yard, is too valuable for him to spend in picking up rusty nuts, and trying to put them on new bolts, when he can get a new nut on very much quicker and get the car out of the way. I know on one of our small divisions it was considered economical to take the crooked spikes drawn out of the rails and send them to the blacksmith shop to have them straightened out; but the cost of straightening those spikes was equal to the cost of purchasing new spikes. It would have been more economical to send the material to the scrap heap and to have bought new material to use on the equipment.

Mr. Sanderson—As I understood Mr. Rhodes' remarks, the meter that he considered proper to use was the accounting, the cost. I would like to hear from some of the gentlemen, who have carried that more into detail than we have done, tell us something of the methods employed. All I know about are as follows: Piecework cost for repairs, passenger and freight; the cost per car cleaned, monthly statements for comparison; the cost per car inspected at each point, monthly comparison; the cost of brake-shoes per thousand miles; the cost of brasses per thousand miles; cost of lubricant per thousand miles; cost of gas per thousand miles; cost of ice per thousand miles. Beyond this I have never seen any one go.

Prof. H. Wade Hibbard (Cornell University)—I think we are handicapped as railroad men because we are not in competition. The point I wish to make is from my observation around the railroad shops, that the machine tools are not worked at anywhere near the amount of work they will turn out if they were being used in a contract shop.

Mr. P. H. Peck—I believe most of the leaks are in the train service; there are more there than you can meter. If you get an honest foreman he can watch the men in the shop, but the great leaks are in the train service. We can watch the shops but not the trainmen.

Mr. West—Railroads that have been as unfortunate as the road with which I am connected which has had to turn engines over to contract shops for repairs, will find that the cost of repairs is run up 100 per cent. The meters are out of order in one place or the other. We find that when we have repairs made by a contract shop, we have to pay from 50 to 100 per cent. more for the work.

Mr. Canfield—I wish to say a word in defence of modern railroad car shop practice. I claim we have competition. We compare one shop with another for costs. The man in charge of the shop knows he must make as good a showing as his neighbor or his services will not be required. I know of two shops that are compelled to bid against outside competitors, before being permitted to construct their own equipment. They are able to save money by it. The President of our road, or of any other road, knows what other shops are doing, and he expects his shop to do the same. These reports of what each shop is doing are circulated through the country and there is constant competition between railroad shops. The managers of railroad shops who went through the years 1893 to 1897 got pretty nearly down to bedrock and experiences gained at that time will last a lifetime.

Mr. Sanderson—There is another element of competition, and that is the purchasing department. Any railroad shop is up against the competition of the purchasing department all the time, if it is handled properly.

Mr. J. W. Marden (Fitchburg)—I think, in considering meters for leaks, we should be very careful that it does not cost us more to stop the leaks than it will to let them go. I refer now more particularly to picking up certain scrap material and other things about the yard.

The Difficulties Found in the Use of the M. C. B. Brake-Shoe; What Should Be Done to Correct Them?

Discussion on this topic was to have been opened by Mr. C. A. Schroyer (C. & N. W.) In Mr. Schroyer's absence the Secretary spoke of some correspondence between Mr. Schroyer and Mr. W. E. Sharpe (Armour Car Lines) relating to the exchange of triple valves under cars and the effect on leverage.

Mr. Sharpe—It occurred to me that this was a subject of sufficient importance to warrant some action by this Association at this time. There are several makes of air-brakes, each one of which gives satisfaction under conditions which are favorable, but they do not give satisfaction when the triple valves are interchanged. In one case that might be cited, if you were to reverse the triple valves, you would get approximately 20 per cent. more leverage than is required. The result of this is slid flat wheels, possible train accidents, and more serious damage. While on the other hand, with the other reverse you would get approximately 20 per cent. less than the braking power required, which would render the brakes entirely useless. It may not be the general practice to interchange triple valves in that way, and yet it is known to occur at different times and in different localities. It appears that some action should be taken by the M. C. B. Association either to insert a clause in the rules providing that a car must be equipped with a triple valve which is standard to the leverage and other equipment of the car, or to prohibit the exchange of triple valves. I do not believe there is anything in the rules which specifically covers a case of that kind.

Mr. R. D. Smith (B. & M. R. in Neb.)—We are using at the present time some of the valves mentioned for increasing the braking power as the car is loaded, and we have been so satisfied with the trial valves that we have ordered 30 more equipments. I can say that up to the present time they are giving excellent satisfaction, but they have been in service too short a time to tell very much about them; they have been in service about a month.

They can be run, and are run, in connection with other cars, but they require some little manipulation by the trainmen. I have ridden on trains where they had a few of these valves in operation, and also some of the ordinary Westinghouse triples, and before starting down a hill there is a little manipulation required by the trainman, and the cars then will take care of themselves going down the hill.

The President—There is no printed report on the triple valve tests, but Mr. Rhodes has sent a letter. The Secretary read the following letter:

"Please report to the convention that during the last 12 months no triple valves have been presented to the committee for test; that railroads generally seem to be concentrating their efforts at the present time on proper appliances for repairing and maintaining the air-brake equipment that is so rapidly increasing on the freight cars of the country. The growing tendency for increasing the carrying capacity of cars, thereby obtaining the immense advantage of a concentrated tonnage in a limited number of cars in place of a small tonnage distributed through a large number of cars, is becoming so pronounced that it is drawing the attention of inventors to the necessity of having an air-brake that will adapt itself to loaded cars as well as to empty cars. While the braking power on empty cars of to-day represents 70 per cent. of the weight of the car, it does not represent more than 20 per cent. of the weight of the car when loaded. There is undoubtedly room for improvement in this matter, and a demand from the railroads will bring it about."

Mr. Smith—The valves that I referred to a moment ago are those which Mr. Rhodes mentions in his letter. We have seven of them on cars that are running in particularly bad places. Both Mr. Rhodes and I have been watching the operation of the valves, and we are so well satisfied that we have placed an order for 30 more of them.

Mr. West—I ask Mr. Smith if they have had any trouble with their trainmen manipulating the retainers on the present quick-action brake over the same territory?

Mr. Smith—We have been through all the troubles that railroads usually have on hilly roads. The trainmen go over the cars and set the retaining valves all right enough, but in addition to that they set all the hand-brakes and then use a club. That is what we have

in the way of hills. There is a notice put up on the side of these cars telling the brakeman just what to do to set this special feature of this triple valve, and on the same notice it tells him he is not to set the hand-brake or use a club on it. That has been the practice with these cars, and as I said before it has been so entirely satisfactory that we thought it was worth going into further.

Mr. George L. Fowler—In connection with the method of getting increased braking pressure on a loaded car, I will say that I did some experimental work a short time ago and I obtained a braking pressure of 70 per cent. on loaded car, and 70 per cent. on a light car, by a simple combination of two brake cylinders and two reservoirs, with one three-way cock between, so that by turning the cock I would have the full pressure for a loaded car on my brake-shoes, and turning it back I would have the pressure for an empty car.

Mr. Canfield—I have been doing some experimenting and I think the time has come when we must get more braking power on the loaded car. It can be done by a double set of brakes, or a slotted lever, so that you can change your fulcrum point. There is another question, and that is, how much braking force should we have on the cars? Are we not liable in giving the brake 70 per cent. of the loaded car, to heat our wheels too high and get into more trouble from the heating of the wheels than we would have by not having such a brake? I have arranged a device which increases the braking force on loaded cars from 17 per cent. to 34 per cent., and in making some tests a short time ago we took one car and charged the reservoir and got the car running at a speed of 12 m.p.h., and with the fulcrum point in the light car position, after cutting loose from the engine the car ran 280 ft. Taking the car back over the same course, and making the same test, with the fulcrum point in the loaded position, the car ran only 140 ft., which indicated to me that 34 per cent. of the load weight was enough.

Mr. Smith—Mention has been made of retaining valves. I think this question of retaining valves should receive more attention than it has received up to the present time. Take for instance a long sleeping car, fitted up in the way in which sleeping cars are usually piped; that is, the retaining-valve pipe is coupled to the triple and then runs out to the end of the car and up on the platform. That means about 35 ft. of pipe. The retaining valve, I believe, is tapped for a ⅜-in. pipe, while the hole in the triple valve is ½ in., and that means a restricted opening through the pipe half the length of the car, and it means the dragging of the brake when the other cars will release. I believe that is the cause of some of the complaints we receive of sleeping cars running hard. The Westinghouse Company has lately made some retaining valves with a larger opening, and I believe they have just been put in trial.

Mr. E. M. Herr (Gen. Mgr. Westinghouse A. B. Co.)—I will say that the Westinghouse Company has recently gotten out a retaining valve for the heavy passenger equipment with the idea of giving a freer opening, and I will also say for the benefit of the members, as it is a matter which has come up in discussion, that we have not been entirely blind to the needs in the braking situation and are working on devices for the braking of the car according to its load and for recharging the auxiliary reservoir. We feel that it is not at all certain that the recharging device for recharging the auxiliary is going to be an unmitigated benefit. There is a question whether the retaining valve, properly maintained and handled, is not an entirely satisfactory solution of the problem of letting trains down a long grade.

Brake-Shoe Tests.

Mr. Simons—In connection with this report [See the *Railroad Gazette*, June 20, page 456] I want to say that the majority of the Committee, although not deeming it advisable to embody it in the report, think it would be well to bring up the question before the Association as to the advisability of making a good brake-shoe test under the name of the M. C. B. Association. There has been very good work done by the Committee on Laboratory Tests of Brake-Shoes, but we have nothing on record to check these results. This will mean the expenditure of money and time on the part of the Association and the Committee making the tests. The idea was to get something that would be an official record for the M. C. B. Association.

It was my idea to go into it on the basis of some of the Westinghouse tests made several years ago. They were obtained in a satisfactory manner, and were the best I have seen since the Galton tests back in the '70's. I believe we should have more information about the brake-shoes than we have. I do not believe we can get it by scattering the tests among the different railroads. I believe some system should be selected whereby we can measure and determine what we are doing in the way of brake-shoes. When you consider that the railroads of the country pay in the neighborhood of $6,000,000 a year for brake-shoes, the fact is impressed upon us that we should try to get some further information on the relation of brake-shoes to wheels than we have at the present time.

Motion to refer the matter to the executive committee was carried. The meeting then adjourned.

Second Day's Proceedings.

The meeting was called to order at 9:30 a.m. The first subject was the report of the Committee on Tests of M. C. B. Couplers, presented by Mr. W. P. Appleyard (N. Y. N. H. & H.), a short abstract of which follows:

TESTS OF M. C. B. COUPLERS.

The work of the committee has been very much hindered on account of the drop testing machine at Altoona being constantly used for other purposes. This being the only testing plant to which the Association has access, the notices to the various railroads to submit couplers could not be sent out and these official tests had to be postponed until better facilities are provided for taking care of them.

Considerable breakage of the frames of the contour gages has been experienced, which we think will be eliminated by the changes as shown in revised drawing. A solid web is used in the weak parts of the frame and part of the outside flange increased to ¼ in. in thickness. Although the hand hole is reduced in size, it is just as convenient as the larger one, and permits of much greater strength and stiffness.

As these gages are used with large, heavy castings and often require some forcing to pass over small lumps on the contour faces, your committee has chosen this means of strengthening and stiffening the frames according to the suggestion of the gage-makers. They much prefer this method to that of using semi-steel or any material that would bend or take permanent set, it being much preferable to have a gage break rather than become distorted by dropping or by undue forcing.

The worn coupler gage continues to be a valuable assistance in discovering and condemning dangerous couplers. Some criticism has been made as to its severity in condemning couplers which are judged to be entirely safe, but your committee is not convinced that this criticism is just. It may be admitted that a little more margin might be allowed in gaging couplers with long guard arms, and to take care of this, while both kinds of guard arms are in service, small caps or thimbles might be used on the ends of the slides of the present gage, when used with long guard-arm couplers. This is merely a suggestion, as your committee has not been able to go into the matter thoroughly enough to recommend at this time any change from its present use.

Your committee is sure, and the opinion seems to be very general, that the abandonment of the link-pin holes and link slots would be the greatest improvement to the automatic coupler that could be made at the present time, but there still seems to be some objection to making this change until some supplementary device is found which will be entirely satisfactory and adequate for handling cars around short curves in mill yards and at warehouses, as well as on and off boats where the water level varies greatly.

From an inspection of 400 knuckles of various different kinds, taken at random from a scrap pile, it was found that 37½ per cent. of the failures were due to the link-pin holes and 21 per cent. to the link slot, while 12 per cent. and 29½ per cent. of the failures were due to the tail and to the knuckle-pin hole, respectively, which plainly shows how great a saving would be effected by the use of the solid knuckle. It also shows that there is a great weakness at the knuckle-pin hole, where the trouble will be much harder to remedy.

Increased Dimensions of Coupler Head.

Your committee has made some few tests of the head presented last year for experiment, which suggest first of all, that it is impracticable to use a 1⅝-in. pin in a head 8 in. between lugs. For these tests a type of coupler was used in which the end of the tail of the knuckle fitting squarely against the head showed, after the specification test, that the pin had been relieved of considerable punishment. Even in this type of coupler the 1⅝-in. pins in the three tests made were bent ¼ in., ¼ in. and $^{5}/_{16}$ in., while in two of them the knuckle would not open after three blows at 5 ft. and two blows at 10 ft. This shows plainly that the longer pins will bend in the holes unless they have large enough section to give them the required stiffness.

A striking test of a coupler of the same type and same distance between lugs, but with 3-in. lugs instead of 2½-in. and a 1¾-in. knuckle pin showed a perfectly straight pin after the test, and the knuckle and locking devices remained operative until the seventh extra blow at 10 ft., which broke the knuckle through the knuckle-pin hole, and the pin then only showed a scant $^{1}/_{16}$ in. bend. From this it seems that a knuckle with an 8-in. hub can hardly be recommended with the present contour, from the fact that the 1⅝-in. pin bends too much, while the 1¾-in. pin increases the present weakness through the knuckle-pin hole and at the lugs of the bar.

The 13-in. face for the knuckle, as suggested last year, does not seem advisable, since one 10 in. deep proves to be stronger through this part than through the hub.

In view of the fact that we hope very soon to be able to abandon the link-pin holes and link slots, which will make this the strongest part of the knuckle, and transfer almost the entire breakage to the knuckle-pin hole, it seems that this extra depth is not the direction toward which we should be working. We would rather look for some way to get a bar with stronger lugs as well as a knuckle much heavier and stronger through the knuckle-pin hole, where even now with the 1⅝-in. pin, the percentage of breakage is very great. To do this would mean a change in contour, which might be done so gradually that little difficulty would be experienced. Your committee realizes that this is a serious proposition, which will have to be faced sooner or later, in order to get the additional strength in the lugs of the bar, and in the pin, as well as in the knuckle; at all of which places the failures are becoming very serious. Your committee thinks that increased strength of lugs will be better obtained by an increase in section rather than in depth, which may also be said of the knuckles at the pin hole.

Another feature of the experimental head presented last year, is the increase of 1 in. in the distance from back of horn to inside face of knuckle. Some types of couplers may need this for strength or for providing more room inside for knuckle and locking devices, while other types do not need it. As your committee does not know of any reason why this distance should be maintained exactly the same, knowing well that it can not be less than it is now or much greater on account of the extra weight of metal unnecessarily involved, it is recommended that a little latitude be allowed to the discretion of the makers and that this measurement not be specified.

To sum up, your committee believes that a head 11 in. or 12 in. deep, with a 9-in. or 10-in. face for a solid knuckle, the contour of which should be changed to admit the use of a 1¾-in. pin would meet all the requirements of the heaviest service, but thinks that another year's experience with these heavier types is necessary before any definite recommendations can be given.

Five comparative pulling tests have been made with the increased butt riveted up in different combinations, the approximate results of which are shown. From these results it appears that the strength of the lips with two rivets is very much in excess of any direct drawbar pull ever found in service. Whether a third rivet is needed to give extra stiffness or to stand excessive shocks, only experiment can determine, which also will be necessary to prove the advantage of the short rivet method over the old one.

A General Testing Plant at Purdue.

The placing of a Coupler Testing Machine at Purdue University has been approved by the Master Car Builders' Association, which has also expressed its willingness to pay for and place this machine there. Although the arrangements for this are favorable to both sides, yet the machine has not been furnished, and before going further, your committee would like to recommend that it be so constructed that the Association can make all its various tests of this character at Purdue, including draft riggings, axles, etc. In other words, this should be a general testing plant, where the different tests can be made according to schedule at different times during the year.

Your committee has brought this general feature of the work to the attention of Professor Goss, who is very much interested and who will be very glad to assist in realizing it in case the convention decides to proceed along this line. The propositions of the University are very liberal. During the coming year your committee hopes to see the testing plant at Purdue well established, which will afford better facilities for picking out the best couplers on the market. The rough handling and weights of trains and cars is increasing so rapidly that extra strength in couplers must soon be provided in the best way, and to this end your committee hopes to make tests and experiments along lines already suggested.

This report was signed by Messrs. R. N. Durborow (Chairman), W. P. Appleyard, Joseph Buker, W. S. Morris, F. H. Stark.

DISCUSSION.

Mr. Sanderson—I would like to refer to the remarks of a portion of the report and on page 3 in which the Committee states that it is its opinion that the strengthening of the coupler should be made by a change in the contour lines in preference to increasing the depth of the coupler. The experience that I have had in this line leads me to believe that the recommendation is absolutely right.

Mr. Waitt—It seems to me that the Association can at this time very wisely put itself on record in favor of the abandonment of the slot and link-pin hole in the knuckles; not possibly that every one would do it, yet I believe it is time for us to pass a resolution that will bring more closely to the attention and favorable action of the railroads, the abandonment of these two sources of weakness in the coupler. I would make a motion that the Master Car Builders' Association recommend to its members in purchasing M. C. B. knuckles that they specify that the link slot and link-pin hole shall be omitted and in that connection that the Standing Committee on Couplers shall make an inquiry and report to the convention next year the results obtained by that change.

Motion was put and carried.

The President—I think, gentlemen, there is one important recommendation made by the Committee, and that is the location of the testing plant at Purdue University. I think there should be a sentiment expressed on that. I would like to hear from some of the other members.

Prof. W. F. M. Goss (Purdue University).—Mr. President, I do not know what I can say that will add to the information given by the committee. I did not know that the committee was to make a detailed recommendation, which appears in this report, so am not prepared to elaborate a plan further than it is elaborated here in this printed statement. I will say that the conditions under which such a laboratory may be established are identical with those which apply to the M. C. B. brake-shoe testing machines and the M. C. B. air-brake testing plant already located in this laboratory.

Mr. Waitt—I move that the offer that has been made by Prof. Goss on behalf of the University be accepted by the Association in full as outlined in the report of the committee, and that the standing committee on tests of M. C. B. couplers be authorized to carry out their recommendations as to modifications in testing machines so as to make it capable for draft rigging, axles, etc., as they suggest.

The motion was unanimously carried.

The President—I have now the honor and pleasure to introduce to you Mr. E. A. Moseley, Secretary of the Interstate Commerce Commission, who will address you. [An abstract of Mr. Moseley's address will be found on another page.]

STANDARD METHODS OF CLEANING AIR-BRAKES AND ADDITIONAL PRICE FOR LABOR AND MATERIAL.

[*See the Railroad Gazette, June 20, page 457.*]

Mr. C. H. Quereau (N. Y. C. & H. R. R.)—I would like to offer an explanation or an apology which I think is due the Committee and due the Association in connection with this report. Possibly some of you know that for the last six months or more the Chairman of this Committee has been unusually busy, largely in traveling about the country, so that while the report was under way in ample time, and the tests were made, still there had been a number of omissions and some few mistakes in the report due to the absence of the Chairman. And in this connection I wish to advise the members of the Association that a committee representing the Air-Brake Association is present. That Association has considered the report which has been offered by your committee, having investigated the matter, and they have a number of suggestions to make, additions and corrections, which I think will be of great value and I hope, if I am correctly advised, that these representatives of the Air-Brake Association will make themselves known and help us with their advice.

I move that the members of the Committee of the Air-Brake Association be given the privileges of the floor in discussing this report.

Motion seconded and carried.

The President—We would invite Mr. Nellis, of the Air-Brake Association, to open this discussion.

Mr. Nellis spoke at length on the details of the report. We shall print his remarks later.

The President—As there is quite a difference between our committee's report and that of the Air-Brake Association, I will make a suggestion. It seems to me it will be well to have the committee representing the Master Car Builders' Association and the committee of the Air-Brake Association to meet and revise the two reports and report this at a later meeting of this convention.

A motion embodying the President's suggestions was made and carried. The convention then proceeded to take up the revision of Rules of Interchange.

MAINTENANCE OF STEEL CARS.

Mr. W. H. Lewis (Nor. & West.)—I am not sure but that it was a mistake to refer this subject to a committee. The question of maintenance of steel cars is not materially different from the question of maintenance of locomotives, and it would be a rather hard proposition for us to find a fixed method of maintenance of locomotives. The steel cars have not been in use long enough to consider anything in connection with their maintenance except possibly the damages that may occur to them by reason of accident, and the most vital question would be the maintenance of these cars due to age and natural deterioration. You understand that prior to 1898 we had no steel cars to speak of. In 1897 the principal steel car manufacturer, namely, the Schoen Pressed Steel Company, turned out 501 cars. In 1898 it turned out 2,931; in 1899, 9,624 cars; 1900, 16,671, and 1901, 24,590. The total of cars manufactured by that concern up to June 1 of this year was 63,872 cars. Assuming that we have in addition to the cars that were built by the Schoen Company in the neighborhood of 8,000 or 10,000 cars of structural steel or other designs than the pressed steel, it would represent at the present time that we have approximately 70,000 cars in service, which represents about one-half of one per cent. of the total equipment of the country, and it would therefore appear that there is not enough of this equipment distributed, and it has not been in service long enough to permit railroad companies to formulate rules and to provide facilities for the systematic repair and maintenance. As a general proposition I do not believe that any railroad company has yet made any effort to provide special facilities for the repairs of these cars, and I do not know of any special tools for the maintenance of steel cars. We are building and maintaining the structural steel cars with practically the same tools and the same facilities that we always had. The work is being done by the same class of labor that we always had on car repairs. We have found that it does not require any special skilled labor to maintain a steel car. It is true, the use of the pneumatic tool has aided very materially in the construction and maintenance of the steel car. I assume, however, that with the more general adoption and general use of the steel car, special facilities will have to be provided.

Mr. Stark—The railroad companies have not made any advancement in the way of shop facilities, although I believe some of the roads have it under consideration. The question arises whether a shop should be provided with overhead traveling cranes similar to an extensive locomotive shop. Steel cars that are badly damaged require a greater length of time as a rule, to make the repairs than do wooden cars, and when you have a long track with a number of cars on it, you have some cars blocked in by reason of the fact that some of the cars on either end of the track are incomplete. The question suggests itself whether we should have some means to take a car out at any time and get it in service and bring another car in in its place. With this same arrangement cars could be mounted on their trucks very readily where trucks are damaged, and it has even been suggested that a car could be laid over on its side and the side straightened out more readily if the car could be put in such a position. With such an arrangement as that, no doubt they would have adjacent to this repair shop a lean-to where we would have the rolls and shears and punches and such things as that. These are matters which a great many railroad companies have under consideration. Mr. Lewis has stated it does not require boiler makers to repair steel cars. At the Mount Clare shops in the beginning some skilled workmen were set at this work, boiler makers, and they did principally the fitting and riveting up, employing cheaper labor to cut out. But the amount of the output was limited by the number of riveting gangs and that divided the responsibility as to the length of time it required to make the repairs. We have now organized gangs of four men that take the car right from the beginning and do all the repairs, and we find it works out better. We can keep track of the amount of repairs required and place the responsibility on those that are responsible, and we find that we are going to be able to establish piece work on steel car repairs much more readily than on wooden cars, there not being so many different operations. As it is to-day, if a foreign road damages a car it is at liberty to charge the owner for whatever labor they may put upon it. We should establish some precedent so that other roads if they are not fitted up for the repair of steel cars, would have an inducement to make such arrangements, by providing themselves tools so that the work can be done in a reasonable length of time.

STANDARD AXLES AND SPECIFICATIONS.

[*See the Railroad Gazette, June 20, page 456.*]

E. D. Nelson (P. R. R.)—Since the report was written, the committee has concluded that it was justified in making a recommendation concerning a modification of the present specifications in steel axles. In 1896, when these specifications were first prepared, there was very little known through the medium of the drop-testing machine in regard to the two larger axles. Since that time considerable information has been collected and it is quite plain that the limits for deflection for the first blow as given in the specifications are too high. I have some figures which will make it clear, the records being taken on the Pennsylvania Railroad.

In the case of the 4¼ x 8-in. journal axle, out of 59 heats there were only six where the deflection was 7½ in. or greater. The present specifications allow 8 in. For the 5 x 9-in. axle, out of 247 heats, there were only five which exceeded 6½ in. The present specifications allow 7 in. In the case of the 5½ x 10-in. axle, out of 159 heats, there were none which exceeded 4½ in. The limit now is 5½ in. Therefore, in view of these figures, and the fact that the axle drop-testing machine is one of the most important things we have in connection with the quality of the axles, the committee recommends new limits as follows:

For axle B, the desired deflection, 7 in., which is the same as at present. The limiting deflection, 7½ in. instead of 8 in.

For axle C, the desired deflection 5¾ in. instead of 6 in., and the limiting deflection 6¼ in. instead of 7 in.

For axle D, the desired deflection 4 in. instead of 4½, and the limiting deflection 4½ in. instead of 5½ in.

In a general way, the stiffer the axle, the less will be the general deflection. The information we have received leads us to believe we get better service from a stiffer axle. Stiffness can be given to the axle either through carbon or phosphorus, or it may be given through the treatment in the forge shop. If an axle is forged at a low temperature, it will have greater stiffness than an axle forged at a higher temperature, although the chemical constituents may be the same. The drop test therefore seems to be of final importance in the testing of axles. Our record on the Pennsylvania shows that these deflections can be changed, because axles bought under the present specifications show much less deflection than is now required. The committee feels if the deflections are made less, the requirements are more consistent with the chemical constituents which are now specified.

There is nothing in the specifications which definitely takes care of segregation of material at the top of the ingot when it is cast, and it is well-known that the amount of carbon towards the top is greater than further down. It decreases until you get to a point where the chemical constituents are properly distributed. If the manufacturers do not cut off enough of the top of the ingot, they get segregated axles, and when the axles are put under the drop test they are liable to break. The practice is to cut off 25 per cent. of the top of the ingot before blooms are made from it.

Mr. Waitt—I believe that it is desirable in a specification for axles to be assured of the use of heavy hammers in making our large axles, and also of the use of a sufficient amount of hammering to get the axle in good condition. By limiting the weights and limiting their dimensions, without carrying the limitation to extremes that are impracticable, it is impossible to make sure that a manufacturer cannot make large axles under a light hammer, and it is possible to prevent his turning out an axle that has not been sufficiently hammered to make it first-class from that standpoint.

The recommendations of the committee were submitted to letter ballot.

EXAMINATION OF CAR INSPECTORS.

[*See the Railroad Gazette, June 20, page 457.*]

The Secretary read the report of the Committee on Code of Rules for the Examination of Car Inspectors.

Mr. Stark—In these days when we are running high speed trains and high capacity cars, we should have as inspectors men of intelligence. I regret to say that in some cases the standard of our inspectors has been going backward instead of forward. There are exceptions to this, of course. Certain circumstances have brought this about. Years ago the wages paid for car repairers were better, in proportion, than the wages paid for other labor, and consequently there was a better class of men who took up railroad work. Then again the equipment has grown so much heavier that the work of a car repairer is a good deal harder, and the average American would prefer to do something else than repair cars. Thus we are forced to employ a large number of foreigners, illiterate men who cannot get employment in other lines of work; hence the railroads find it difficult to get intelligent inspectors. One of the essentials of elevating the standard of car inspection is larger compensation. We can hardly expect a young man to follow car oiling for a year for $1.30 a day with nothing in view, except $50 per month. If we want more intelligence and a better class of men, I believe we have got to compensate them better.

The meeting then adjourned.

Third Day's Proceedings.

SPLICING PASSENGER CAR SILLS.

Mr. J. S. Lentz (Lehigh Valley) presented the report of the committee.

Mr. Lentz—Mr. Chairman, I would say that the idea of the committee in recommending that both of these forms be submitted to letter ballot is to give the members an opportunity to make tests similar to those made by the committee to ascertain for themselves whether the results obtained are correct; and so that they may vote intelligently on the subject.

Mr. W. E. Fowler (Nev.-Cal.-Ore.)—Last winter the Southern Pacific at Sacramento, made some very interesting compression tests in splicing. The question came up as to whether the standard splice was advisable where the splices are likely to come under compression, so we cut off sections out of one sill about 4 ft. long, one without any splice in it, one with the standard M. C. B. splice, and one with the reinforced splice. We found, however, that neither of the spliced sections came within about 40 per cent. of standing the compression test. Then we afterwards made the test of the step splice with largely the results shown, so I am strongly in favor of the step splice, which I see allowed of 146,000 lbs. under compression test and under transverse test 208,000 lbs., which I think would be most advisable.

Mr. Waitt—I was very much interested in reading this report, and, like the committee, was somewhat surprised at the result which favors the plain step splice. I would move the recommendation of the committee, that the four forms shown be submitted to letter ballot under the conditions, which the committee suggested.

The convention then proceeded to take up the Rules of Interchange and the recommendations of the Arbitration Committee.

The Secretary—Mr. Waitt offers the following resolution:

Resolved, That in view of the vital connection of the work of the Master Car Builders' Association both in the past as well as at the present time, with the safe operation of railroads and with the harmonious interchange of cars and the adoption of standards in railroad equipment, this Association requests of the various passenger traffic associations special consideration in the continuation of free transportation to and from its annual conventions.

Resolved, That the Executive Committee of the Master Car Builders' Association communicate with the various passenger associations asking for such special consideration.

The resolution was seconded and carried.

The President.—The next business in order will be the report of the Committee on Draft Gear.

DRAFT GEAR.

[*See the Railroad Gazette, June 20, page 457.*]

Mr. Quereau (N. Y. C.)—It occurs to me that the results of the drop test are of doubtful value in determining the draft gear we want, simply because I am inclined to believe they do not represent service conditions. For instance, the shearing of yoke bolts was due to the comparatively light weight striking a blow at high speed. In that feature no particular information would be obtained from the drop test. This fact was due to the comparatively light weight striking a blow at high speed, which are not service conditions. As I understand it, the drop weighed 1,640 lbs.; this is approximately $^1/_{20}$ of the light weight of a car, of 60,000 or 80,000 lbs. capacity. If to that we add the load for which the friction draft gears are designed to be of advantage, it would be roughly $^1/_{100}$ of the weight of the mass on which the

(*Continued on page 513.*)

Early History of the Delaware, Lackawanna & Western Railroad and Its Locomotives.*

BY HERBERT T. WALKER.

PART V.—THE NORTHERN DIVISION.

But the days of the M. & E. R. R. as a separate corporation were numbered, for on Dec. 10, 1868, it was leased to the D., L. & W. R. R. Co., the lessees assuming all liabilities and agreeing to pay 7 per cent. per annum on the capital stock, and interest on the bonds, and on February 9 of the following year the lease was duly ratified by the Legislature.

The road then became the "Morris & Essex Division," and its subsequent history will be recorded hereafter, for it is now time to take up a history of the D., L. & W. R. R. proper, which is of special interest, for the reason that although it was opened for traffic at a comparatively recent period it is the nucleus of the present "Lackawanna Railroad" System—the various railroads touched on in the course of this article having been leased, purchased or otherwise acquired by its owners at various times. Another reason is that some of its locomotives were of a type that mark the successful anthracite coal burning engine of to-day and were among some of the earliest of their class. These engines were not designed to attract business by offering cleanliness and comfort to passengers—for the early hard coal burners were all freight engines, but simply to utilize a class of fuel the Company were endeavoring to create a market for, and so extending their business.

These matters will be subsequently dealt with in detail, but for the present we will say that the railroad in question was organized in 1849, and was opened for traffic two years later. To get at its origin, however, we must go back to the year 1826, when, according to Hollister†, the best authority on the subject, one Thomas Meredith conceived the idea of a railroad leading from the mouth of Leggetts Creek in Providence, to Great Bend on the Susquehanna—about 48 miles, to be called the "Lackawannock and Susquehanna Railroad," or the "Meredith Railroad," but the name of "Leggetts Gap Railroad" was ultimately chosen, and the Act of Incorporation was approved April 7, 1832. The original Commissioners of this railroad project were 16 in number, among them being Jeremiah Clark, Dr. Andrew Bedford and Henry W. Drinker. A route was surveyed by James Seymour four years after the granting of the charter, and was nearly identical with that of the present railroad between Scranton and Great Bend. The projectors of this road never expected to carry passengers, or to run the trains other than by horse power (or, at most, stationary engines) and inclined planes. The scheme did not grow in favor, and the matter was postponed for want of capital. Supplemental acts of incorporation were passed in 1836, 1842 and 1847, thereby extending the period within which operations might be commenced, but its final success was due to the advent of the before-mentioned Colonel G. W. Scranton more than any other single individual. Col. Scranton was born in Madison, Conn., in the year 1811; he came from good English stock and his ancestors figured honorably both as officers and enlisted men in the French Revolutionary wars. He was the founder of the city of Scranton, originally named Scrantonia, but the classical termination was soon dropped. He was also the originator of the vast coal and iron industries of that locality, being a member of the firm of Scranton & Platt, afterwards known as the Lackawanna Iron & Coal Co. He was, moreover, a Christian gentleman and a public benefactor until the time of his death.

The charter of the Leggetts Gap Railroad having been purchased at the suggestion of Col. Scranton, a meeting of the Commissioners to obtain subscriptions to the capital stock was held at Harrison (now Scranton) March 7, 1849, and the amount of stock then subscribed by 56 individuals was 5,026 at $50 each, say $251,300. A new charter, signed by Governor William F. Johnston March 14, 1849, was obtained, and a survey was made in the same year. The first meeting of the stockholders for the election of officers was held at Harrison Jan. 2, 1850, when John J. Phelps was elected president and Selden T. Scranton, treasurer. Major Edwin McNeil was the chief engineer. The charter of this Company empowered them to own 1,000 acres of coal lands.

In the spring of the same year, Col. Scranton was appointed general agent, construction work being commenced immediately afterwards under his personal superintendence. Soon after the work was begun, D. M. Dotterer, who was connected with the firm of Dotterer & Darling, engine builders, of Reading—which firm supplied the Scranton & Platt Iron Works with steam engines and machinery, was engaged as mechanical superintendent.

Following the example of the Erie Railroad, the track gage was made 6 ft. The construction work was done by the day, and not by contract, the work being executed by Peter Jones. Although matters were pushed as rapidly as possible, various difficulties were encountered and delays arose as shown by a paragraph in the *American Railroad Journal* of May 25, 1850, which says: "Leggetts Gap Railroad. *The Honesdale Democrat* announces that this work has been commenced by breaking ground in Abington Township, Wyoming County, at the summit between the Lackawanna and Tunkhannock Creeks. The prospects of completion are not at present very promising. The Ithaca & Owego Railroad, which belongs to the Leggetts Gap Railroad Co., has been placed in complete repair, and when the new improvement is made there will be a direct line of travel between the Lackawanna coal fields and the New York & Erie Railroad."

In order to draw income from the road at the earliest possible day some sections over valleys were built of trestle work made of rough timbers. These trestles were gradually filled in with earth so as to form embankments and were then known as "fills." The principal "trestles" were at Factoryville and Humphreys Hollows. There was also extensive trestle work for the switch over the Tunkhannock Mountain, to enable the road to be opened before the Tunkhannock tunnel was completed.

In the construction work, mules and horses were employed, but as they gave some trouble, especially on the trestles, it was decided to get one or two locomotives. It will be remembered that we left the engine "Old Puff" in a shed on the Cayuga & Susquehanna Railroad. Col. Scranton remembered this, and ordered it to be sent to Scranton. He also, at the instigation of Mechanical Superintendent Dotterer, decided to buy one of the old engines belonging to the Philadelphia & Reading Railroad. Dotterer was a friend of Millholland, master mechanic of that railroad, and was naturally more in favor of getting an engine that had done good service, than being troubled by a locomotive with such an evil reputation as "Old Puff." However, it was decided to have both engines and "Old Puff" was shipped on a raft at Owego and floated down the Susquehanna River to Pittston, and from thence by the Pennsylvania Coal Company's gravity road to Scranton. The axles of the engine were then pieced out, the frames widened, and a saddle cast to bring the cylinders in line for the 6 ft. gage. In the order book of Rogers, Ketchum & Grosvenor there is an entry under date of April 15, 1851, stating that G. W. Scranton, general agent for the Leggetts Gap Railroad, ordered a new smoke pipe, scale and lever for the safety valve and one good steam whistle for this engine, the parts to be forwarded to Scranton & Platt, Scranton, via Erie Railroad to Narrowsburg. The engine was then got ready for service, and the cylinders being so far apart and the boiler so small, it had an ungainly appearance and never did satisfactory work. It was renamed "Pioneer" and commenced service about April, 1851, hauling ties and rails, and was the first engine on the Leggetts Gap Railroad.

Early in the same year a supplement to the railroad charter was presented, and on April 14 was approved, changing the corporate name of this railroad to "Lackawanna & Western Railroad." At about the same time arrangements were made with the Philadelphia & Reading Railroad Co. for the purchase of one of their old engines as before mentioned. This engine's name was "Spitfire," and it is shown in Fig. 12. Probably few locomotives have done longer or more varied service than this engine, for to get at its origin we must go back to England and the year 1838. In that year the firm of Braithwaite, Milner & Co., having shops in the New Road (now the Euston Road), London, built several locomotives for the Reading Railroad, one of them being the "Spitfire," which was put to work on that road in June, 1838. After doing good service and covering 109,268 miles it ceased running in 1849. In the Reading Railroad Company's annual report for 1850 it was listed as being "in order, ready for use." It was then sold to the Leggetts Gap Railroad Co. for the sum of $3,067.50. For these particulars the writer is indebted to Mr. Charles D. Spohn, late cashier of the Reading Railroad General Passenger Department, Philadelphia.

Mr. J. Timothy Jackson, an old Reading engine driver, informed the writer that he ran this engine in 1840 and sometimes speeded her up to 30 miles an hour with a light train. Mr. E. J. Rauch, another old-time engine driver on the same railroad, who was a friend of Dotterer and Millholland, and who was, until quite recently, engine despatcher at the 155th street terminus of the Manhattan Elevated Railway, was employed by Dotterer to bring the engine from Reading. Mr. Rauch states that in April, 1851, he, with the assistance of his brother, Mr. W. B. Rauch, conveyed the engine by the Pennsylvania Canal to Pittston and thence to Scranton by the same road as the "Pioneer" was sent over. The axles of the "Spitfire" were lengthened to line with the 6 ft. track by the Reading Railroad Co., and as the original coupling rods were removed when the engine went out of service, Mr. Dotterer bought a pair that were on the scrap pile in the Reading yards. They belonged to the old Norris engine "Manatawny" and were of peculiar design as will be seen by the illustration. Mr. E. J. Rauch drove this engine on construction work between Scranton and Great Bend, and when that was finished, it was used as a drill engine and did many more years of service as will be shown in due time.

The leading dimensions of "Spitfire" were: Cylinders, 9½ in. diameter by 16 in. stroke; driving wheels, 51 in. diameter; boiler, 35 in. diameter by 7 ft. 6 in. long, containing 86 copper tubes 2 in. in diameter; wheel base, 5 ft.; total heating surface, 440 sq. ft. The bell and sand box were added by Superintendent Dotterer, also a new stack, which was specially made for this engine by Rogers, Ketchum & Grosvenor. The engine weighed about nine tons. It was inside-connected and had full cranks.

The most interesting detail of the engine is the valve gear, which was peculiar to the Braithwaite and some of the old Bury engines. It will be seen that the cylinders were low down so as to clear the leading axle, and were connected to the rear axle, which carried the eccentrics. The eccentrics had long blades with offsets on them to clear the front axle. These blades extended through an opening in the smoke-box between the valve chests, and had D hooks at their ends; these hooks were raised and lowered for reversing by arms and links operated by a tumbling shaft journaled on the bottom rail of the frame, which was of the "bar" type, a long reach rod extending back to a hand-lever in the cab as shown. The valve stems passed forward through the valve chests and had blocks forged on them; these blocks had lateral pins to member with the D hooks, and were mortised out to receive the lower ends of two rocker arms fastened to two shafts, one working within the other, and journaled in boxes bolted to the top rail of the frame. The upper ends of these rocker arms were forked and had pins to engage with D hooks on long rods that extended back to the cab where they were actuated by two hand-levers fixed on shafts (one within the other) journaled in a bracket bolted to the fire-box. The previously described valve stems were guided by brackets bolted to the valve chests.

It will thus be seen that to reverse the engine the long hand-lever was first moved so as to drop the required set of hooks, then the two short levers were worked back and forth, thereby moving the valve stems until their pins were caught by the hooks and the engine was then in the required gear. This cumbersome arrangement gave some trouble to young enginemen. When much switching was done an experienced hand could throw all the eccentric blade hooks out of gear by placing the long hand-lever in an upright position, and then working the slide valves by the two short levers.

It is obvious that when the engine was traveling the two short hand-levers moved in unison with the valve stems, and as it was inconvenient to have moving parts

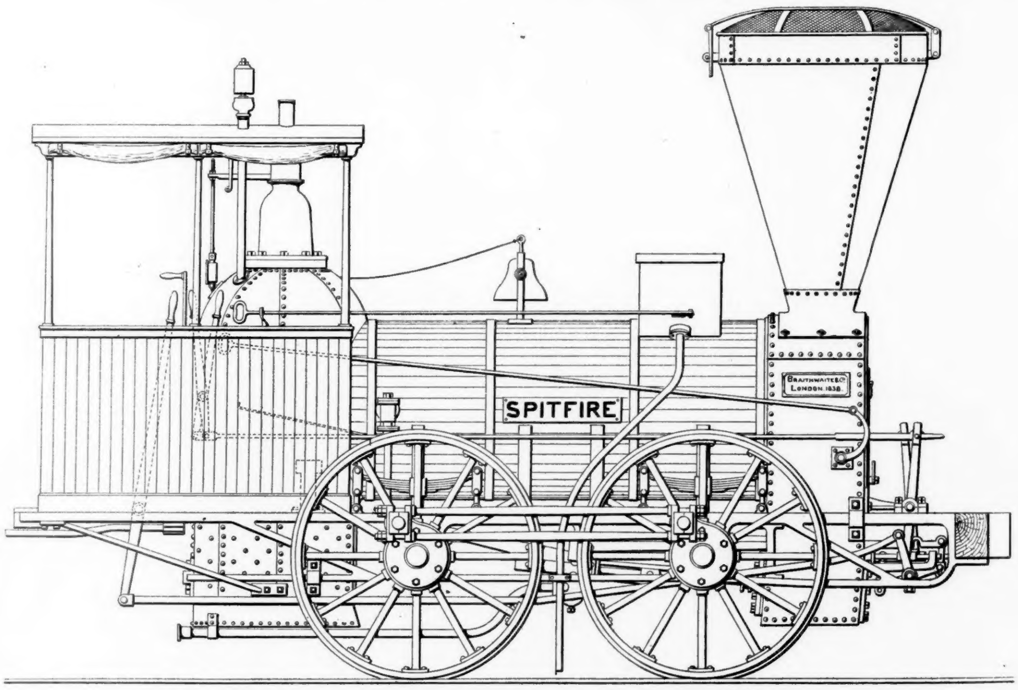


Fig. 12.—Leggetts Gap Railroad Construction Engine, 1850.

† History of the Lackawanna Valley, Philadelphia, 1885.

in the cab, a curved arm was provided pivoted on the smoke-box. This arm was fitted with a roller, so that when it was pulled over by means of the handle shown, the roller lifted the hooks on the long rods clear of the rocker-arms, and the levers in the cab thus became stationary, whilst the rocker arms continued to move with the valve stems.

Mr. Rauch states that he has hauled 45 four-wheel cars each containing 4½ tons of freight with this engine.

Whilst the building of the railroad is progressing, and the two construction engines are at work, Mr. Rauch on the "Spitfire" and a young man named Gould doing the best he can with the "Pioneer," we will take up the important matter of the road locomotives. In this connection the writer's thanks are due to Mr. David Brown, master mechanic, and Mr. James A. Mellon, chief draughtsman, at Scranton, for much valuable data, including a carefully compiled engine list, forming a ground work for the laborious investigation this subject has involved.

It is worth placing on record that some of the older projectors of this railroad were, and had been from the first, in favor of stationary engines for working the

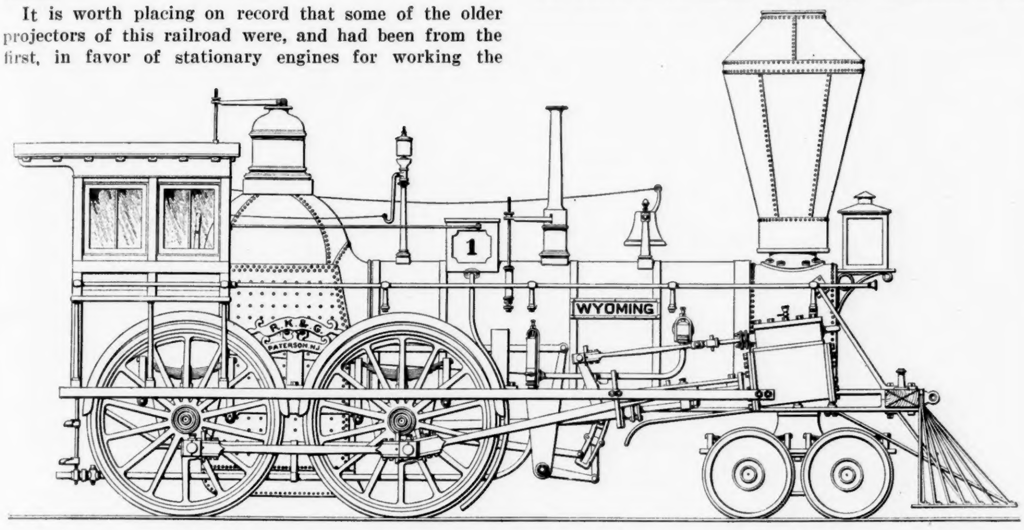


Fig. 13.—Lackawanna & Western Railroad First Passenger Engine, 1851.

trains, as coal or freight was expected to be the chief if not the only class of business the road would handle, but these antiquated ideas were swept aside by the advent of Col. Scranton and his associates, and the only question was where to purchase the engines.

Superintendent Dotterer, who was a good mechanic, was in favor of placing the order with some Philadelphia or Reading firm, which was natural, as he was from that part of the country, but Col. Scranton having in mind the good engines built at Paterson for the Cayuga & Susquehanna Railroad, determined to order them from Rogers, Ketchum & Grosvenor. Accordingly, we find in the order book of that firm, under date April 15, 1851, an order from G. W. Scranton, general agent of the Leggetts Gap Railroad, for three locomotives and tenders similar to the "Simeon De Witt," also three locomotives and tenders, cylinders 18 in. diameter by 20 in. stroke, and six 5 ft. driving wheels. Engines to have copper flues. Inside-connected. Single crank. A supplemental entry dated July 5, 1851, reads: "Mr. Dodge says *deliver freight engines first.* Eight wheel engines to have outside cylinders."

The freight engines were delivered as follows: June 10, 1851, engine "Lackawanna," Shop No. 262; June 25, engine "Tunkhannock," Shop No. 266; September 13, engine "Capouse," Shop No. 278. All these engines had cylinders and wheels as ordered, and the price was $10,500 each. They were all mates.

The passenger engines were delivered as follows: Sept. 26, 1851, engine "Wyoming," Shop No. 281; October 4, engine "Montrose," Shop No. 282; October 31, engine "Abington," Shop No. 287. All had cylinders 16 in. diameter by 20 in. stroke, and four coupled 66 in. driving wheels. Price $8,700 each. These three engines were of similar design, and, with all the others made at Paterson, were shipped over the Erie Railroad to Great Bend.

The time was now approaching for the opening of the road, and a short description of it will not be out of place. Starting from Scranton, 740 ft. above tidewater, the line crosses the Lackawanna river and ascends the Tunkhannock Mountain on an average grade of 75 ft. to the mile. About two miles from Scranton is Leggetts Gap, locally known as "The Notch." The ascent continues to Clark's Summit, seven miles from Scranton and 502 ft. above that station. Here there was a wood station and a spring of water before the tank was built. Some fast running, to the terror of passengers, and unbeknown to the superintendent, was done on this grade down to Scranton, when enginemen wanted to get home in time for supper. From Clark's Summit the grade falls at the rate of about 62 ft. per mile to the south branch of the Tunkhannock river. The road then ascends a ridge called Ark Swamp stretching between the main Tunkhannock and its south branch. This ascent averages 20 ft. to the mile and the summit is passed by the Tunkhannock Tunnel, 2,250 ft. long—a work of some magnitude and well constructed. On leaving the tunnel the grade descends to the Tunkhannock river, which it crosses at an elevation of 78 ft. From this point the line follows the Martin's Creek valley for about 19 miles until it reaches New Milford summit, 418 ft. above Scranton, the grades being about 21 ft. per mile. From this point the road descends about 35 ft. per mile to the Susquehanna river, which it originally crossed by a Howe truss bridge 600 ft. long in order to connect with the New York & Erie Railroad at Great Bend, 53½ miles from Scranton. The above description is of the line as originally built, some deviations having been made in later years. The names of the original stations between terminals, going north, were Clark's Summit, Abington, Factoryville, Tunnel, Tunkhannock, Hopbottom, Oakleys, Montrose and New Milford.

The engine "Lackawanna" was the first to arrive from the builders, and this and other engines did construction work up to the last moment before the line was ready for traffic. The track was not then ballasted. The rails weighed 56 lbs. to the yard, laid on hemlock ties. There were no fish plates, but a cast-iron chair at each joint with an extra heavy tie beneath it.

The first through train from Great Bend to Scranton was drawn by the engine "Wyoming," illustrated in Fig. 13. It was well proportioned, and weighed about 29 tons. It had the Stephenson link motion, and calls for no special description as the boiler mountings and finish were similar to the "Ithaca" (Fig. 2). The original stack was of the French & Baird design (as on the "Ithaca"), but this was subsequently removed for a reason that will be explained presently, and one of Radley & Hunter's stacks substituted, as shown on the drawing. Radley & Hunter purchased the patent right of the French & Baird design and introduced some improvements of their own which they patented Jan. 22, 1850. The V shaped circles—a prominent feature of the

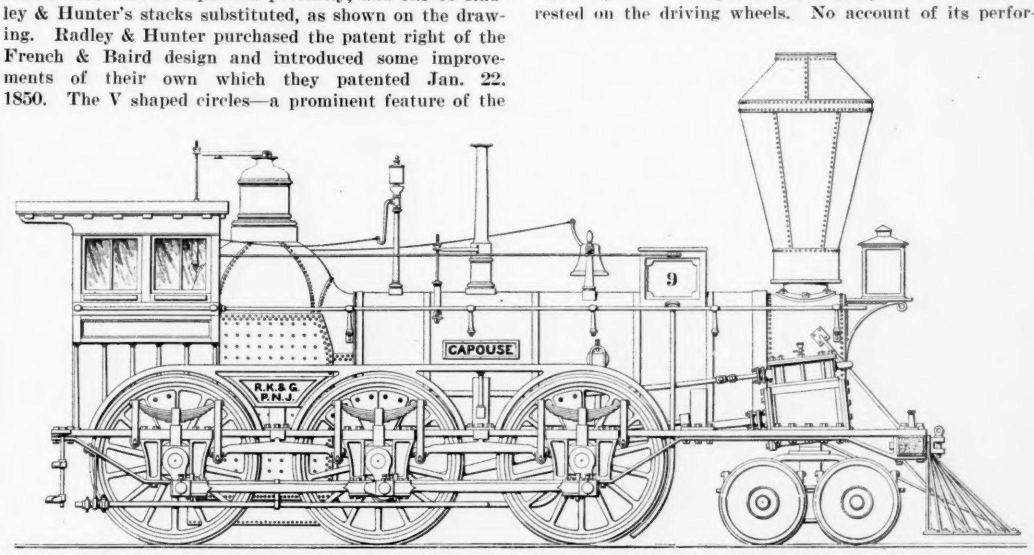


Fig. 14.—Lackawanna & Western Railroad First Freight Engine, 1851.

French & Baird stack, were discarded, thus improving the draft, and this Radley & Hunter stack is used on many engines to-day.

As above mentioned, the first train was drawn by this engine, and the "engineer" was Mr. Francis A. Brown. Unfortunately, he cannot remember the exact date, but it was somewhere about Oct. 15, 1851. The train was a "special" and consisted of half a dozen coaches and flat cars which waited at Great Bend for the arrival of some of the directors from New York, who came in on the regular Erie Railroad train. The Lackawanna & Western train then started for Scranton, the cars being nearly filled with the directors and their friends. Mr. Brown states that he made the run in about three hours, including the stops for wood and water. Mr. E. J. Rauch was at Scranton and saw the train come in. He states that the day was fine and warm and a great crowd of people awaited the train, a platform having been erected at the south end of the Lackawanna bridge for the accommodation of invited guests. The party stayed for two or three days to visit the coal mines and workings and then returned to Great Bend. On this trip, Mr. Brown relates that the "Wyoming" ran out of steam and "laid down" at a point that is now between Foster's and Kingsley's stations. The cause of the stop was the "patent" smoke-stack, the perforated deflecting plates of which had become clogged with ashes, thus obstructing the draft. Mr. Brown opened the smoke-box door to allow the smoke to escape and ordered the fireman to climb up to the stack with a hammer and cold-chisel and knock some holes in the V-shaped circles previously described. When the sound of hammering was heard, a stoutly built, active man, with somewhat stooping shoulders and a keen but pleasant countenance, jumped from one of the cars and hurried up to the engine with the inquiry, "Engineer, what's the matter?" This man was Thomas Rogers. Mr. Brown explained why the fireman was knocking holes in the stack and suggested that in future the perforations be made larger. He then had the brakeman cut the engine from the train and ran her up the track for a mile or so to create a draft, and then, having about 75 lbs. of steam they resumed the journey, arriving at Great Bend just in time for the Erie train for New York, to the satisfaction of Rogers and the directors who had feared they would miss it and thus be delayed a whole day.

The road was opened for regular traffic on Monday, Oct. 20, 1851, and Superintendent Dotterer made out a time-table for the one passenger train, which was in charge of Conductor Marcus Blair (a son of John I. Blair), and Mr. Brown was the "engineer." The train left Scranton at 9 a.m., arriving at Great Bend at 11:30. Returning, the train was scheduled to leave Great Bend at 6 p.m., providing the Erie train from New York was on time, but it was likely to be late, and sometimes passengers did not get to Scranton until midnight. The solitary water tank was at a stream near a point now called La Plume, and when this froze up the train would either get stalled, or drift into Scranton with the water level nearly on the crown sheet of the fire-box.

Mr. Brown saw some hard service in the early days of this railroad and was subsequently appointed master mechanic of the Cayuga division, which position he filled until 1872. He was the inventor of many devices pertaining to railroads, nearly all of which were patented and many of them used, but none has brought him a single dollar of compensation.

The next engine to be described is the "Capouse"—named after an enlightened and peaceable Indian Chief whose domains included the Capouse Meadows, on which the city of Scranton now stands. This was the first freight engine to be put to regular work on the L. & W. R. R., and is shown in Fig. 14. Mr. O. W. Adams, an engine driver who is still in the company's service, ran this engine in his early days and was much attached to it.

Some further dimensions of "Capouse" are worth noting. Boiler, 48 in. diameter; tube surface, 1,180 sq. ft.; fire-box surface, 72 sq. ft.; total heating surface, 1,252 sq. ft. Weight about 65,000, of which 49,000 rested on the driving wheels. No account of its performance is obtainable, but it will be remembered that the "Tunkhannock," a sister engine, was sent to the Cayuga & Susquehanna Railroad, and one of its performances has been already described. The "Capouse" had half cranks, outside frames, cast-iron pedestals, Stephenson link motion and Radley & Hunter's stack.

(To be Continued.)

Arnold's Electro-Pneumatic Motor Car.

At the convention of the American Institute of Electrical Engineers, at Great Barrington, June 20, Mr. Bion J. Arnold, after reading his paper on "Electric Power for Heavy Railroad Service," which is given in another column, gave a brief description of a system which he has designed for utilizing compressed air, stored on each car, in the propulsion of electric cars. He said that he was constructing 20 miles of road* to be worked by this

*The road to which Mr. Arnold refers is the Lansing, St. Johns & St. Louis. The line begins at Lansing, Mich., and runs northward to St. Johns on the Grand Trunk (D., G., H. & M.), and thence to St. Louis on the Pere Marquette. It was briefly described in the *Railroad Gazette* of Feb. 21 last, page 134. The length of the entire projected line is 60 miles. The part of the line on which the track is finished is that between Lansing and St. Johns. We understand that this portion has been in operation some time, steam locomotives being used.

system; and the necessary trucks and motors are being built. Mr. Arnold believes that it will be necessary ultimately to abandon the direct current motor for heavy and long distance service. The main points of his description are as follows:

1. A single phase or multiphase motor, mounted directly upon the car, designed for the average power required by the car, and running continuously at a constant speed and a constant load, and, therefore, at maximum efficiency.

2. Instead of stopping and starting this motor and dissipating the energy through resistances, as is customary with all other systems, I control the speed of the car by retarding or accelerating the motor, by means of compressed air, in such a manner that I save a portion of the energy which is ordinarily dissipated through resistances, and store it to assist in starting the car, helping over grades, for use in switching purposes, and for the operation of the brakes.

3. By this method of control I secure an infinite number of speeds from zero to the maximum speed of the car, which may or may not be at the synchronous speed of the motor, for with the air controlling mechanism at work compressing, the speeds below synchronism are maintained, and by reversing the direction of the air through the controller, speeds above synchronism may be attained for reasonable distances. This feature gives to the alternating current motor the element absolutely essential for practical railway work, for it permits a car or train to ascend a grade at any speed with the motor working at its maximum efficiency, and imparting its full power to the car. When descending the grade the motor may utilize its full power drawn from the line in compressing air, or it may be used to compress air with the stored energy of the train, thereby acting as a brake.

4. By virtue of the air storage feature each car becomes an independent unit and capable, in case of loss of current from the line, of running a reasonable distance without contact with the working conductor, and this without the aid of storage batteries. This feature will be valuable in switching and in crowded cities.

5. Since a single-phase motor can be used the motors can be supplied with current from a single overhead wire or third rail, and with a single rail return circuit, thus permitting the overhead constructions, or third-rail construction, to conform to the standard of to-day, except that a much higher working voltage can be used, provided the insulation is taken care of. In steam railway work the use of only one of the track rails will be required for the return circuit, thus leaving the other rail for the use of the signal system.

6. The current will be taken from the working conductor at any voltage up to the limit of the insulation, and in case this voltage is high (I am building my line for 15,000 volts), a static transformer will be carried upon each car and the pressure reduced from the line voltage to the voltage of the motor, which, in the case under construction, is designed for 200 volts. Where it is unnecessary to utilize so high a line pressure the motor may be designed for the working voltage and the current fed directly from the working conductor into the motor, thus eliminating the static transformer. When a high voltage working conductor and static transformer are used, and it is thought advisable to use a working conductor through cities or towns this working conductor will be supplied with energy through a stationary transformer at each city limit.

7. By virtue of the speed of the motor and its constant load, either when the car is in motion or when it is standing still and motor compressing air, the variable load now customary in electric railway power plants is eliminated, and the power station works at practically a constant load, thereby eliminating a large part of the investment at present requisite in power station and line construction. Furthermore, by virtue of the air storage feature, each car, in the particular apparatus I have designed, is capable at any time when current is on the working conductor of delivering to the car wheels a much greater torque in proportion to the capacity of the motor than is possible with any electrical system known to-day.

Railroad Accidents for the Last Quarter of 1901.

The Interstate Commerce Commission has issued its Accident Bulletin No. 2, summarizing the reports received by the Commission of collisions, derailments and casualties to passengers and employees during the three months ending Dec. 31, 1901.

The number of persons killed in train accidents was 272, and of injured, 2,089. Accidents of other kinds, including those sustained by employees while at work, and by passengers in getting on or off cars, etc., bring the total number of casualties up to 11,048 (813 killed and 10,235 injured). These accidents are classified in the following table.

Table No. 1.—Casualties to Persons.

	Passengers.		Total employees.	
	Killed.	Injured.	Killed.	Injured.
In collisions	47	609	152	870
In derailments	4	142	60	310
Miscellaneous train accidents, including locomotive boiler explosions	..	11	9	147
Total in train accidents	51	762	221	1,327
Coupling or uncoupling cars	..	...	38	577
While doing other work about trains or while attending switches	..	1	25	980
Coming in contact with overhead bridges, structures at side of track, etc.	2	3	25	324
Falling from cars, or engines, or while getting on or off	23	344	157	1,873
Other causes	9	273	262	3,771
Total (other than train accidents)	34	621	507	7,525
Total, all classes	85	1,383	728	8,852

The number of passengers reported killed in collisions and derailments during this quarter is large; nearly as large as in the quarter preceding, in which there were three collisions and one derailment that caused 47 fatal accidents to passengers. In the present record there are many serious butting collisions, one in November, between fast passenger trains, causing the death of at least 23 passengers. This collision (the last one in the list given below) was mainly due to forgetfulness on the part of an engineman of long experience. The trains were ordered to meet at a station where it appears there was no telegraph office, so that there was no station signal to be used as a check on the possible forgetfulness of enginemen.

Of the other passengers reported killed in November, five met their deaths while riding on freight trains, four rear collisions of freight trains, fatal to passengers, having occurred in that month. In October only one passenger was killed in a train accident. In December there were 20, of whom 10 were killed in two butting collisions. In both of these cases conductors and enginemen of experience, and with long records of apparently satisfactory service, ran past the station at which they had been instructed to meet the opposing train. The reports do not indicate that the men had been overworked in either case.

The collisions and derailments are classified as below:

Table No. 2.

	Number.	Loss.
Collisions due to trains separating	199	$101,611
Other collisions	1,282	1,238,202
Total collisions	1,481	$1,339,813
Derailments due to defects of roadway etc	128	106,922
Derailments due to defects of equipment	376	295,861
Derailments due to negligence of trainmen, signalmen, etc.	70	38,720
Derailments due to accidental causes	54	95,139
Derailments due to malicious obstruction of tracks, etc	15	14,414
Derailments due to other causes	234	184,222
Total	877	735,278
Total collisions and derailments	2,385	$2,075,091

The average loss by each collision was approximately $904, and by each derailment $838.

As noted above, the class of accidents which was most disastrous to the lives and limbs of passengers in this quarter was butting collisions—trains meeting head to head, and in many cases at nearly or quite full speed. The total amount of damage caused to cars and roadway by collisions of this class was $480,771. Of this sum more than five-eighths ($306,511) is chargeable to 27 collisions, in which 70 persons were killed and 234 injured. To more fully show the character of this important feature of the accident record, the following table has been prepared, showing in brief the causes of these 27 collisions, these being the most notable cases in the record:

Causes of Twenty-seven Butting Collisions.

Record. No.	Train.	K.	Inj.	Damage.	Cause.
14	Pas. and fght.	..	..	$2,500	Despatcher gave conflicting orders.
34	Pas. and fght.	..	..	2,500	Conductor and engineman of freight disregarded rule of superiority of trains and occupied main track on the time of the passenger train. These men had been on duty 14 hours, 25 minutes.
12	Pas. and fght.	..	9	2,985	Mistake in telegraphic order.
38	Fght. trains.	1	4	3,000	Ran past the meeting point.
17	Fght. trains.	..	..	3,400	Conductor and engineman overlooked meeting order.
33	Fght. & loco.	..	..	3,400	Engineman (employed by a contractor, not by railroad company) misread an order—read 6 for 62.
39	Fght. trains.	..	6	4,600	Engineman neglected to observe train-order signal indicating "stop."
5a	Fght. trains.	..	4	4,900	Conductor and engineman "overlooked" opposing train.
15	Fght. trains.	..	..	4,900	Operator failed to deliver order.
5c	Pas. and fght.	4	4	4,990	Assumed (without warrant) that a wreck would block the road and thus protect against opposing train.
3	Pas. trains.	..	..	5,700	Engineman forgot meeting order.
11	Pas. trains.	..	9	6,000	Engineman (experienced) started from station 3 minutes ahead of time.
37	Fght. trains.	2	8	6,600	Engineman met a certain train: assumed it to be another train: failed to stop and positively identify.
4	Pas. and fght.	1	..	7,400	Operator delivered an order not correctly written; had been in service 6 months.
7	Fght. trains.	..	..	7,500	Operator (of 5 years' experience) failed to deliver telegraphic order.
40	Fght. trains.	2	..	7,500	Train failed to wait at station as ordered.
35	Fght. trains.	..	..	8,000	"It is supposed that the engineman (of one of the two trains) had lost his bearings."
6	Fght. trains.	4	..	8,200	Mishandling of orders by despatcher and operator.
13	Pas. and fght.	..	12	9,200	Operator (of 5 years' experience) neglected to deliver order; had been on duty 10 hrs.
36	Fght. trains.	1	..	9,500	Order not delivered. Day operator went off duty without notifying night operator that an order was on hand to be delivered.
65	Pas. and fght.	4	30	10,000	Train ran past the oppointed meeting station.
5	Pas. and fght.	..	10	10,600	Conductor and engineman of freight overlooked on the time-table the schedule of the passenger train.
5b	Fght. trains.	3	1	12,000	Neglected to send out flag.
16	Fght. trains.	4	9	12,136	Conductor and engineman failed to carefully read train register.
67	Pas. and fght.	11	..	41,800	Forgot telegraphic order or miscalculated time.
60	Pas. trains.	7	17	72,200	Left station 5 minutes earlier than special order authorized.
57	Pas. trains.	26	111	35,000	Engineman forgot or misread meeting order.
	Total, 27 col.	70	234	$306,511	

It is to be observed that in most cases the brief sentences giving the causes of these collisions do not by any means afford a satisfactory explanation of the precise circumstances which resulted in the accident. Some of these paragraphs have been condensed [by the Commission], but most of them state the cause in substantially as full detail as it is given in the railroad company's report to the Commission. The law requires the companies to report the causes of collisions and the circumstances accompanying each; and the Commission, with a view to facilitating the making of reports and to avoid unnecessary clerical labor in gathering facts which are not needed, has directed that the report shall state the cause or causes as reported to the general manager or other chief officer, by the local officer in immediate charge of the division of road where an accident occurs. This requirement, however, is not very well complied with; that is to say, in a case of negligence—nearly all collisions are due to negligence—the manager seems to be satisfied with a statement, for example, that a telegraph operator failed to deliver a meeting order; or that a conductor, in consulting the time-table schedule of a superior train, made the mistake of reading the wrong column, or overlooked a word or figure; or again, a statement showing that an engineman forgot that a certain order had been delivered to him, but not showing whether or not the conductor of the train, equally responsible with the engineman, did or neglected to do anything to check or correct the engineman. As reports are made under oath by officers acquainted with the requirements of the law, the Commission is fairly justified in assuming that these incomplete statements are deemed by the men who make them reasonable explanations. In many cases, no doubt, the disciplinary action taken by the division officer throws additional light on the case, sufficient to make the report satisfactory to the general manager. The facts concerning dismissals and punishments are not, however, reported to the Commission, except by a very few managers, the custom of years in reporting to State authorities being, no doubt, the guide that is followed in this respect. But the object aimed at in requiring the causes of accidents to be recorded in a Government office is to gather such data as may be ascertainable concerning the remedy that should be applied for the removal of such causes; and to this end the reports to the Commission should be full and explicit. In view of the somewhat experimental nature of the reports, the Commission has not as yet required the amendment and amplification of individual reports (the need of which is here indicated) except in a very few cases; but it seems likely that, if the purpose of the law is to be accomplished, it may become necessary to issue a more detailed code of rules for the description of collisions and their causes. It is obvious that any one of the causes set forth in the foregoing list of 27 cases might lead to as great loss of life and property as was caused by the worst collision in the list. The simplest error may produce the greatest disaster. The first step, therefore, in any movement looking to the reduction of the railroad-accident record—which record may not unfairly be characterized as a reproach to the country—is to learn and state the causes of accidents in such full detail as may be necessary to make possible a thorough analysis.

The number of fatal "coupling accidents," 38, is considerably larger than in the preceding quarter. This increase, no doubt, may be fairly attributed to the increased dangers incident to colder weather, and in part also to the greater number of freight trains run on the principal lines in the autumn.

The bulletin contains tables, like those which appeared in Bulletin No. 1, classifying the causes of accidents to employees in coupling and uncoupling cars, and in falling from cars and engines.*

*Reports of the principal train accidents occurring in the three months embraced in this bulletin were published in the *Railroad Gazette* of Nov. 29, Dec. 20 and Jan. 31. The worst accident in the quarter was the collision at Seneca, Mich., Nov. 27. The next most serious case in that month was the butting collision of passenger trains at Franconia, Ariz. In October there were 16 accidents of sufficient consequence to be specially mentioned in our summary, but there was only one train accident which was fatal to a passenger. In December the accidents fatal to passengers were at Malvern, Ark.; Macon, Ga.; Essex, Mont.: Malta, Ill., and Perryville, Ill. The last named (a butting collision) was the most disastrous accident in December.

Casualties in Train Accidents in 1901.

The appearance of the Interstate Commerce Commission's Bulletin No. 2 enables us to give the total number of passengers and employees killed in train accidents in the last half of 1901. For the first half of that year the *Railroad Gazette* record showed casualties, as noted below; adding these two records together we have for the calendar year 158 passengers and 654 employees killed, 2,436 passengers and 3,357 employees injured. The totals, with those of the two preceding years, are:

Casualties in Train Accidents.

	Pass. k'll'd.	Pass. inj.	Emp. k'll'd.	Emp. inj.
Last half 1901 (Govt. record).....	108	1,999	404	2,712
First half 1901 (*Railroad Gazette*).	50	437	250	645
Total, 1901	158	2,436	654	3,357
Total, 1900 (*Railroad Gazette*)....	112	842	452	1,199
Total, 1899 (*Railroad Gazette*)....	113	888	402	1,095

In all of the items except that of passengers killed, the Government record is no doubt much more complete than ours and the reader must not infer that in all of the four items the actual record was very much worse in the last half of the year than in the first half; though it is a fact that such was the case in the first item (passengers killed). This great difference is due chiefly to two very bad collisions: one in August and one in November, with which the reader is already familiar.

The Exhibits at Saratoga.

Numerically, the exhibits of railroad materials and supplies in connection with the annual conventions of the Master Car Builders' and American Railway Master Mechanics' Associations were about equal to last year; but in amount of space occupied the display was larger, notwithstanding the fact that several large concerns whose exhibits during the 1901 meetings covered a considerable area made little or no show this year. Last year, in reviewing the exhibits, we stated that without doubt many new designs of draft rigging would be brought out. This prediction was realized, as was naturally expected in view of the attention given the subject by the Master Car Builders' Association. There was also a noticeable increase in the number of companies who showed applications of acetylene for lighting purposes.

As in previous years, the exhibits were distributed along the rear verandas and in the courtyard of the Grand Union Hotel, excepting the cars and locomotives, which were located on the tracks of the Delaware & Hudson Co. a short distance from headquarters. A complete list follows:

The Adams & Westlake Co., Chicago.—The exhibit of this company was unquestionably the most artistic and elaborate on the grounds. It was designed to show the Adlake acetylene gas lighting system and was a reproduction in general appearance of the booth shown at the World's Fair, Chicago. It consisted of a small pavilion about 30 ft. square, surmounted by a dome, the whole painted ivory white and gilded and provided with over 200 acetylene lights. All varieties of ceiling, wall and panel lights were shown, and at the rear a full-size section of a car was built as a dark room to illustrate the system in the daytime. Seven generators were in operation and photographs and drawings of the application were shown. The apparatus was described in the *Railroad Gazette*, Nov. 22, 1901.

The E. D. Albro Co., Cincinnati, O.—Samples of fine-sawed figured mahogany veneers: some 30 panels of finished cabinet woods and a case of finished and unfinished woods which was exhibited at the Paris Exposition, receiving a gold medal.

Ajax Metal Co., Philadelphia, Pa.—Two large banners calling attention to the merits of "Ajax" metal and plastic bronze.

American Automatic Lubricator Co., New York.—Showed in operation an automatic lubricator for journal bearings.

American Balanced Valve Co., Jersey Shore, Pa.—Showed a model of the Wilson high pressure balanced valve, their latest improvement, together with the American balanced piston valve; American balanced slide valve, marine type, and American metallic packing for piston rods and valve stems; also samples of the Nixon safety staybolts.

American Brake Shoe & Foundry Co., New York.—A large display of the Sargent, Lappin, Corning, Streeter, Herron, Cardwell, Interlocking and Diamond "S" brake shoes and a small model of the Lindenthal spherical side bearing truck.

American Car & Foundry Co.—Full size models of the Fowler rolled steel car wheel, Haskell pressed steel truck, and of steel body and truck bolsters.

American Locomotive Co., New York.—An exhibit of locomotives on the D. & H. tracks. One N. Y. C. & H. R. standard tandem compound consolidation, cylinders 15 in. and 28 x 34 in., piston valves, 63-in. drivers, boiler pressure 210 lbs., weight on drivers 172,500 lbs., total weight 200,000 lbs., total heating surface 3,480 sq. ft., grate area 50 sq. ft. One D., L. & W. standard simple consolidation, 21 x 26-in. cylinders, balanced D valves, 57-in. drivers, 200 lbs. boiler pressure, weight on drivers 166,000 lbs., total weight 186,000 lbs., total heating surface 2,773 sq. ft., grate area 95 sq. ft. One D. & H. standard simple consolidation, cylinders 21 x 30 in., balanced piston valve, drivers 56 in. diameter, 190 lbs. boiler pressure, weight on drivers 161,000 lbs., total weight 184,000 lbs., total heating surface 3,408 sq. ft., grate area 90 sq. ft. One N. Y. C. & H. R. standard double end suburban engine, cylinders 20 x 24 in., piston valves, boiler pressure 200 lbs., drivers 63 in. diameter, weight on drivers 128,000 lbs., total weight, including tank, 216,000 lbs.; total heating surface 2,425 sq. ft., grate area 55 sq. ft. One N. Y. C. & H. R., R. & A. division, standard fast passenger Atlantic type engine, cylinders 21 x 26 in., 79-in. drivers, piston valves, traction increaser, 200 lbs. boiler pressure, weight on drivers 95,000 lbs., total weight 176,000 lbs., total heating surface 3,505 sq. ft., grate area 50 sq. ft. All of the above from the Schenectady works of the company. One C. R. R. of N. J. Chautauqua type fast passenger engine, cylinders 20½ x 26 in., 85-in. drivers, boiler pressure 210 lbs., piston valves, weight on drivers 99,400 lbs., total weight 191,000 lbs., total heating surface 2,967 sq. ft., grate area 82 sq. ft., from the Brooks works.

American Machinery Co., Grand Rapids, Mich.—Samples of the Oliver wood trimmer and the Oliver universal saw bench.

American Mason Safety Tread Co., Boston, Mass.—Samples of the Mason tread for passenger car steps.

American School of Correspondence, Chicago.—Exhibition of students' work, including drawings, patterns and examination papers; also catalogues descriptive of lines of work and photographic views of Armour Institute of Technology at which the School of Correspondence is located.

American Steel Foundry Co., St. Louis, Mo.—Models of steel trucks and body bolsters and large photographs of tank cars. This company also exhibited a Vanderbilt steel tank car, 100,000 lbs., 12,000 gals. capacity; light weight, 36,600 lbs.; having an overhead running board, and equipped with Sessions Type C friction draft gear.

American Watchman's Time Detector Co., New York.—An interesting exhibit of various types of time detectors and time recorders controlled by them, including the magneto system of watchman's time detector; Morse system of electric time clocks; Morse system employees' time recorder; portable watchman's clocks and fire alarm and interior telephone systems.

American Water Softener Co., Philadelphia, Pa.—An exhibit of water softening apparatus of the Brunn-Lowener patents.

Armstrong Bros. Tool Co., Chicago.—A full line of the Armstrong system of lathe and planer tools, using inserted cutters of self-hardening steel; also samples of the Armstrong planer jack, straight and taper shank drill holders and clamp dogs.

E. C. Atkins & Co., Indianapolis, Ind.—Large easel lithographs advertising segment ground cross-cut saws.

Atlantic Brass Co., New York.—Samples of the A. B. C. journal bearing.

The Auto. Coupler & Supply Co., Cincinnati, O.—Full size Auto. couplers mounted on wooden trucks running on track to show operation of the couplers.

J. H. Baker Mfg. Co., Pittsburgh, Pa.—Wrought iron brake forgings, including brake-rod jaws, brake levers and beams; malleable iron levers; brake pins and keys; wrenches.

Baltimore Ball Bearing Co., Baltimore, Md.—An extensive exhibit of the Norwood ball bearings, side and center bearings for freight and passenger equipment. They showed a heavy center-plate with the center-pin cast integral with the top casting and projecting through the bottom plate. A complete steel body and truck bolster, with their bearings at center and sides, was also shown.

Charles H. Besly & Co., Chicago.—Sample of parallel clamps, Gardner grinders and taps.

Bethlehem Steel Co., Bethlehem, Pa.—This company had an attractive exhibit on the rear veranda of hollow forgings and general locomotive forgings in steel, including axles, side rods and piston rods. A special feature of this exhibit was the display of nickel steel castings and forgings which are rapidly coming into use. Samples of steel treated by the Taylor-White process, together with characteristic turnings made with tools of this steel, were given a prominent place. The exhibit was decorated with large photographs of the company's plant and structures into which their product has entered.

Boston Artificial Leather Co., New York.—Samples of Moroccoline, a substitute for leather, applied to car seats; also an exhibit of strips of all colors and grains of this product.

Boston Belting Co., Boston, Mass.—Samples of air-brake, steam and water hose and other rubber goods adapted to railroad use.

Boston Woven Hose and Rubber Co., Boston, Mass.—An exhibit of rubber specialties for railroad work, including Vim air-brake hose and Vim pneumatic and dusting hose for shop and yard piping of compressed air. Two samples of air-brake hose, which had been in use for four years and were still in perfect condition were also shown.

Brady Brass Co., Jersey City, N. J.—Cyprus bronze journal bearings.

J. G. Brill Co., Philadelphia, Pa.—Full-sized model of the Brill patented truck No. 27, for high-speed steam or electric service. The frame is made of solid forged wheel pieces, angle iron tie-bars and end braces, giving a strong and square frame. The equalizing bars are suspended from the side frames by spring links at points nearly above the journals. The side swing is cushioned and the car takes curves easily at high speed. The whole design is intended to make a strong, rigid and easy riding truck.

Buckeye Malleable Iron & Coupler Co., Columbus, O.—A full size "Major" coupler was shown, together with the separate parts composing it.

Buffalo Forge Co., Buffalo, N. Y.—Down-draft forge and ventilating apparatus.

Bullock Electric Mfg. Co., Cincinnati, O.—This company had in operation a 28-in. lathe to which was geared a Type N Bullock motor. The equipment included a "balancer" and a switchboard, the whole exhibit representing the Bullock multiple voltage system for the operation and control of variable speed motors. The "balancer" cuts up the voltage, supplying the motor three primary voltages, 132, 176 and 242. Through a controller 26 speeds are secured from the motor by using the shunt field resistance. The advantages are, the motor will have a constant torque regardless of speed and when set it will run regardless of load.

Cambria Steel Co., Johnstown, Pa.—On the D. & H. tracks, one structural steel hopper bottom gondola car, Vanderbilt patents, 100,000 lbs. capacity, 36,800 lbs. light weight, for the West Virginia Central; equipped with Sessions-Standard friction draft gear, type "C"; also one low side structural steel gondola car for the P. & R., with drop doors in the floor, capacity 100,000 lbs., weight 33,200 lbs., steel floor and Westinghouse friction draft gear.

Carborundum Co., Niagara Falls, N. Y.—An interesting exhibit of their product in the rough, and samples of this abrasive made up in wheels for all kinds of grinding. An adjunct to this exhibit was a Bath automatic universal grinder, made by the American Watch Tool Co., Waltham, Mass.

Cataract Refining Co., Buffalo, N. Y.—Sample jars of metal cutting solution.

Celluloid Co., New York.—Full line of car seats and drawing-room car chairs, upholstered with Texoderm, duplicates of seats recently furnished to a prominent railroad. Many colors and grains of this material in the piece were also shown.

Chapman Valve Co., Indian Orchard, Mass.—In connection with the exhibit of the General Electric Co., this company showed two gate valves, 12 in. and 24 in., operated by motors and some smaller sizes operated by hand.

L. C. Chase & Co., Boston, Mass.—The company made its usual fine display of the well-known Chase Mohair plush, made by the Sanford mills, and a full line of samples of Chase leather for upholstering seats for smoking and suburban cars and for car curtains and decorations. The leather also is made by the Sanford mills.

Chicago Pneumatic Tool Co., Chicago.—Line of Boyer hammers, Little Giant and Boyer drills, including right-angle and breast drills; pneumatic holders-on for riveting; circulars of compressors and air tools.

Chicago Railway Equipment Co., Chicago.—The exhibit of this company presented an unusually neat and attractive appearance, showing its line of automatic frictionless side bearings, and National Hollow Kewanee, Diamond and Central brake beams; also Sterlingworth and Monarch solid beams. A beam specially adapted to high-speed service was shown, and the Diamond adjustable beam, having adjustable heads and reversible struts, permitting of universal application to trucks.

W. H. Coe Mfg. Co., Providence, R. I.—An exhibit of gilding wheels and samples of work.

Columbia Lock Nut Co., New York.—Samples of the Columbia nut lock.

Commercial Acetylene Co., New York.—Showed their method of lighting cars by acetylene gas carried in a tank under the car filled with asbestos briquettes and charged with acetone, after which the acetylene gas is forced in under pressure. A car from the D., L. & W. equipped with their apparatus, standing on the D. & H. tracks, was used to demonstrate its merits.

Commonwealth Steel Co., St. Louis, Mo.—A very attractive little all-steel model of the Commonwealth truck was shown; also spring seat and body bolster models on the same scale.

The Cook Cooler Co., Flint, Mich.—Cook coolers; Cook's car inspector's outfit, including new form of packing iron, calipers for calipering journals in service, oil conductor and guard, hammer and receptacle for waste; also colored charts showing journals in various stages of heating.

Consolidated Car Heating Co., Albany, N. Y.—Steam heating appliances for car heating, including expansion drums, hose and hose couplings, drip valves, regulating and reducing valves.

Consolidated Railway Electric Lighting & Equipment Co., New York.—Electric car lighting apparatus and fixtures exhibited in cottage D. The private Pullman car "Columbia," used by Prince Henry on his recent tour of the United States, equipped with Consolidated "Axle Light" system of electric lights and fans, on exhibition at the D. & H. tracks. This car carried the delegates from New York to the convention.

W. W. Converse & Co., Palmer, Mass.—Samples of paste for cleaning headlights, etc.

Crane Co., Chicago.—Large line of high-pressure, wedge type, blow-off globe and check valves, with sections showing construction. These valves are made of gun metal for high pressure service up to 250 lbs. and are tested to 800 lbs.; also catalogues of fittings for high pressure. A unique souvenir given away by this company was a cigar cutter and ash tray, the cutter being in the form of an angle glove valve.

S. A. Crone, New York.—Crone rocker side bearings.

Crosby Steam Gage & Valve Co., Boston, Mass.—An artistic display of Crosby steam gages; locomotive whistles; steam engine indicators, and spring seat globe and angle valves.

The Curtain Supply Co., Chicago.—Four-frame standard equipped with complete line of car curtains fitted with roller tip and "Acme" fixtures.

Damascus Brake Beam Co., St. Louis, Mo.—The "Damascus" brake beam made from 5-in. steel I-beams.

Davis Pressed Steel Co., Wilmington, Del.—Exhibit of the Davis solid trussed brake beam; also a sample brake beam in all the stages of construction from the rough bar to the finished product. This device was fully described in the *Railroad Gazette*, June 13, 1902.

The Dayton Malleable Iron Co., Dayton, O.—Exhibit of draft gear showing single, tandem and twin-spring gear, applied to steel and wooden sills; also small models and catalogues of Dayton draft gear; the Dayton freight car door fastener; pamphlets of the Dayton lubricating center plate.

Detroit Lubricator Co., Detroit, Mich.—Full size model and blue prints of a No. 3-C triple feed locomotive lubricator, having automatic steam chest valves and by-pass valves for auxiliary oiling. Full size model of the Detroit graphite lubricator, which will work with any locomotive sight-feed lubricator.

Joseph Dixon Crucible Co., Jersey City, N. J.—An exhibit showing the appearance and quality of Dixon Silica-Graphite paint for steel cars, bridges and other metal structures applied in four colors on a large steel plate. Samples of Dixon's Flake Lubricating Graphite and Dixon's pipe joint compound were also displayed.

Drake & Wiers Co., Cleveland, Ohio.—Exhibiting the new Universal drafting machine, a device for doing away with the regular T-square and triangles.

Dressel Railway Lamp Works, New York City.—Samples of Dressel headlights and lamps and Herculean steel signal lamps.

The Dwight Lumber Co., Detroit, Mich.—Handsome cabinet and extensive line of samples of machine carved mouldings.

Economy Car Heating Co., Portland, Me.—An exhibit of their apparatus as applied to a locomotive and utilizing for heating purposes the exhaust from the air pump.

Economy Locomotive Sander Co., Baltimore, Md.—Single and double, inside and outside track sanders; sections and models of the above.

O. M. Edwards Co., Syracuse, N. Y.—The exhibit of this company was exceptionally complete, including full size models of the Edwards extension platform trap door, Edwards window fixtures and other specialties made by the company. The latest type of extension platform trap door, shown at Saratoga, was illustrated in the *Railroad Gazette* of June 20, page 473.

Edwards Railroad Electric Light Co., Chicago, Ill., and Cincinnati, O.—This company exhibited one of its electric headlight plants in half section, showing the construction of all parts of the apparatus.

Electra-Pura Water Co., New York.—Water purifying machines and apparatus to demonstrate the amount of precipitate in any water and its removal by their process. Especial attention was paid to waters containing alkali and their purification of all organic and inorganic matter.

McDonald Elliott, Chicago.—Acetylene gas generator and locomotive headlight, full size. Rushmore reflectors.

Excelsior Car Roofing Co., St. Louis, Mo.—Full-sized sections showing application of "Improved," "Economy" and "Excelsior" car roofing.

J. A. Fay & Egan Co., Cincinnati, O.—Photographs of woodworking machinery. Exhibit of medal awards.

R. Fitzgerald, Chicago.—Hibbard empty and load valve for freight car brakes.

The Flatau Mfg. Co., St. Louis, Mo.—Weather and fire-proof paints for locomotive front ends and stacks; oil burners for cook stoves, furnaces, boilers and locomotives.

Forsyth Bros. Co., Chicago.—Three full-size models of different types of the "Chaffee" drawbar centering device mounted on end sill and carrier irons to show operation.

Fox Bros., New York.—An exhibit of a new model of a light motor-driven inspection car designed for one rider, with motor attached and driving on the front axle through chain and sprockets. An independent chain and sprocket to the rear axle provides for locomotion by the rider when so desired. Models of the Pritchard Car Replacer were also shown.

General Electric Co., Schenectady, N. Y.—An elaborate exhibit of their motors applied to shop tools, etc. A 12-in. and 24-in. Chapman gate valve were shown, operated by motors; also a 48-in. Norton portable slotting machine, with variable speed motor. A motor generator set taking current from the street railway line at 500 volts and delivering it at 220 volts furnished power for most of the electric machines on the grounds.

The General Manifold Co., Franklin, Pa.—An exhibit of railroad and general manifold and duplicating blanks.

Globe Ventilator Co., Troy, N. Y.—A large model in copper of the Globe ventilator and samples of various styles of car ventilators.

Gold Car Heating & Lighting Co., New York.—The exhibit of this company represented a complete car and locomotive equipment. The piping was arranged full size, the same as when applied to a regular 50-ft. coach. One side is shown fitted with Gold's duplex, double coil, sealed jet system of hot water circulation, and the other with Gold's plain pipe or direct steam system. All of the Gold specialties for car heating purposes were also exhibited, and considerable interest was shown in the Gold electric heater.

Egbert H. Gold, Chicago.—Car heating apparatus under steam. Train pipe valves, traps and steam hose coupler.

B. F. Goodrich & Co., Akron, O.—Large colored picture advertising the Goodrich rubber specialties.

Goodwin Car Co., New York.—A handsome model of the Goodwin car, showing its operation in discharging any kind of a load in bulk. A large book of photographs of this car in operation had a prominent place in the exhibit.

Gould Coupler Co., New York.—Showed in their large booth in the court a new type of Gould coupler for heavy equipment; a tender coupler; spring buffers; improved journal box with inset lid and dust guard; models of the Gould passenger platform and malleable draft gear for freight cars; and a slack adjuster for air-brakes.

Greenlee Bros. & Co., Chicago.—Car shop machinery and tools. Photographs of woodworking machines; exhibit line of bits and chisels.

Hale & Kilburn Mfg. Co., Philadelphia, Pa.—Three full-sized models of the Walkover car seat.

H. G. Hammett, Troy, N. Y.—Allen-Richardson and Richardson balanced slide valves, "Sansom" bell ringer, oil cups and link grinders.

The Handy Car Equipment Co., Chicago.—Full-size models of Snow car and locomotive replacers and the American dust guard. Small wooden working model of the Handy horizontally-swinging pilot coupler.

Harrison Dust Guard Co., Toledo, O.—Harrison dust guard and model of Harrison journal box lubricator.

Heitzmann Tool & Supply Co., Hoboken, N. J.—Two styles of the "Perfect" pressed steel car replacers for high and low rails.

Heywood Bros. & Wakefield Co., Wakefield, Mass.—Samples of latest designs of car seats for steam and electric roads.

Hoke Car Door Co., Chambersburg, Pa.—Full-sized model of the Hoke flush car door. Half-size model of the Hoke car door fastener.

Howe Mfg. Co., Scranton, Pa.—Sand drier shown by model.

Illinois Malleable Iron Co., Chicago.—Small model of the Bruyn automatic swinging smoke-jack.

International Correspondence Schools, Scranton, Pa.—Exhibit of "Mitchell's Models and Easy Lessons in Locomotive Running," being large color plates showing parts of air-brake apparatus. Whenever possible the parts are made movable and the action of the air may be traced by the different colors. Also text books on "Air-Brakes and Locomotives" and on shop and foundry practice.

Jenkins Bros., New York.—A display of Jenkins valves and steam appliances of various sizes and types.

H. W. Johns-Manville Co., New York.—Samples of asbestos goods, including fire-felt covering for steam pipes, sheet fire-felt, locomotive lagging, wick packing; Kearsarge asbesto-metallic packings and gaskets, and vulcabeston molded and pressed rope gaskets and molded rings and union washers.

Jones Car Door Co., Chicago.—Model of Smith car door with full-size fittings. Small model of Jones car door.

Keystone Drop Forge Works, Philadelphia, Pa.—An exhibit of sample drop forgings; Keystone connecting link; crocodile wrenches; safety shackle hooks.

Kindl Car Truck Co., Chicago.—Models of Kindl and Cloud trucks and Woods pedestal roller swing-motion truck.

King Automatic Platform Closure Co., Washington, D. C.—A full-sized model of the King automatic closure platform trap door.

Knitted Mattress Co., Canton Junction, Mass.—Application of knitted elastic padding. Car seats, cab and caboose cushions with knitted elastic padding, knitted mattress for sleeping cars and knitted table padding for dining cars.

Link-Belt Machinery Co., Chicago.—Framed photographs showing some important installations of coaling stations, etc., made by the company.

The Lima Locomotive & Machine Co., Lima, Ohio.—Photographs of Shay locomotives for the Canadian Pacific, the Oregon Short Line, and the El Paso Rock Island Route.

Edward F. Luce, Cincinnati, O.—Car showing the Williams grain door.

McConway & Torley Co., Pittsburgh, Pa.—The Kelso coupler for freight equipment; the improved Janney coupler, and the Kelso swing-head coupler for locomotives.

McCord & Co., Chicago.—McCord journal box, McKim gaskets, McCord spring dampener, Torrey anti-friction metal, Gibraltar bumping post, G. L. M. switch stand. A serviceable souvenir distributed was a 4-in. steel scale in a leather case, which latter bore a number. The numbers were for chances in a drawing for a fine top runabout automobile given away by this company.

The Mann-McCann Co., Chicago.—Small working model of the Westmark flue rattler. Photographs showing views of the McCann railroad grader and bank leveler and of work done by the device.

Manning, Maxwell & Moore, New York.—The exhibit of this company was composed of articles made by the Hayden & Derby Mfg. Co., Ashcroft Mfg. Co., and Hancock Inspirator Co., and included several patterns of Metropolitan injectors, a water heater, hose strainers, check valves, muffler and open pop valves, Hancock inspirators, single screw boiler checks, duplex boiler checks with inside stop valve, Ashcroft steam gages, Hancock main steam valves and boiler washers.

Mason Regulator Co., Boston, Mass.—A full line of steam appliances and regulating devices, together with an automobile engine of their design.

Merritt & Co., Philadelphia, Pa.—Expanded metal lockers.

Metal-plated Car & Lumber Co., New York, N. Y.—Full size section of passenger coach plated with sheet copper.

The Michigan Lubricator Co., Detroit, Mich.—This company had a very attractive exhibit of sight-feed lubricators; also samples of its automatic driven brake retainers, and automatic steam chest plugs.

Michigan Mfg. Co., Ypsilanti, Mich.—This company exhibited a new type of sight-feed lubricator known as the McCoy positive feed, which is a departure in appearance from the types of such lubricators already in use.

Nathan Mfg. Co., New York.—An interesting exhibit of the improved Monitor injector, with line check; the reflex water gage; Nathan sight-feed lubricators and metal guards for gage glass tubes and lubricators.

National Car Coupler Co., Chicago.—Models of improved freight coupler, Class L; Hinson Class N coupler, similar to Class F, with friction applied above and below yoke, instead of at rear end; National combination coupler; National steel platform and continuous platform buffer for passenger cars.

National Lock Washer Co., Newark, N. J.—Full size models of the National car curtain fixture; also samples of nut locks.

National Malleable Castings Co., Cleveland, O.—Extra heavy Tower coupler.

National Railway Specialty Co., Chicago.—Dunham and Security car doors; National adjustable journal bearings; N. R. S. hose clamp.

New York Leather & Paint Co., New York.—Samples of Fabrikoid, a substitute for leather, in different colors and grains.

W. H. Nicholson Co., Wilkesbarre, Pa.—Expansion lathe mandrels and shaft compression couplings.

A. O. Norton, Boston, Mass.—Samples of ball bearing journal jacks, lifting jacks, track jacks and bridge jacks.

Pantasote Co., New York.—Section of a parlor car showing Pantasote curtains and seats upholstered with Pantasote. The seats and backs of the chairs were done in an embossed design, which made a rich and attractive appearance. The exhibit was lighted at night by the Adlake acetylene system.

Pearson Jack Co., Boston, Mass.—King-bolt clamp, Pearson car replacing jacks, ratchet pulling jacks, ratchet journal jack, U. S. car pusher and Goodwin brake-beam clamps.

Peckham Mfg. Co., New York.—A motor truck for high-speed service, designed for the Aurora, Elgin & Chicago electric line, to be run at a speed of 70 miles an hour.

Philadelphia Pneumatic Tool Co., Philadelphia, Pa.—This company had the only exhibit of pneumatic tools in operation on the grounds. Their booth in the court was supplied with compressed air from the Rand Drill Co.'s exhibit, and in it they showed a complete line of pneumatic tools. A number of each of three sizes of riveting hammers were shown, the largest to drive rivets up to 1¼ in. diameter. One of these was in operation driving rivets in a heavy plate. Five sizes of chipping and caulking hammers were on view, one in operation chipping strips ½ in. to ¾ in. from the edge of a boiler plate. These hammers are remarkably rapid and free from vibration and have a capacity of cutting a chip from a ⅝-in. plate ¾ in. deep at the rate of 1 ft. a minute. In operation were four sizes of rotary pneumatic drills, the largest size being one for a 3-in. drill. Foundry rammers made in three sizes were shown; one designed especially for concrete tamping, a smaller size for hand molding on floor work, and a large size, suspended from above, for heavy work.

Protectus Co., Philadelphia, Pa.—Samples of wood and iron painted with Protectus paint. Also samples of the S. & M. wood cleanser and the S. & M. stain.

Piper Friction Draft Gear Co., Cleveland, O.—Full size Piper friction draft gears Nos. 1 and 2, as applied to any sills and any coupler.

E. L. Post & Co., New York.—Post zero babbitt metal for journal bearings.

Pyle National Electric Headlight Co., Chicago.—Photographic views illustrative of the advantages of the electric headlight.

The Railroad Gas Lighting Co., Chicago.—This company has its own exhibit car equipped with two acetylene gas generators, lamps, and an acetylene gas stove. This car was on exhibition on the D. & H. tracks.

Railway Appliances Co., Chicago.—An auxiliary coupling, a new device for working on short curves was shown; and small models of the Gilman-Brown emergency knuckle; also full-size models of Ajax canvas vestibule diaphragms for Gould and Pullman vestibules.

The Railway Materials Co., Chicago.—This company exhibited a full-size Ferguson flue welding oil furnace in operation. A Ferguson locomotive fire kindler was also shown.

Rand Drill Co., New York.—An exhibit of air compressors; one two-cylinder steam compressor with flywheel; one compressor operated by a gas engine and a belt driven compressor.

Republic Railway Appliance Co., St. Louis, Mo., and Chicago.—Full sized Republic friction draft gear. Small model of gear applied to wooden sills. Republic dust guards.

Robins Conveying Belt Co., New York.—A model of the Robins conveyor with 5-in. belt, showing its operation in handling material in bulk; also samples of conveying belts and photographs of installations made by the company. The model shown is the same as exhibited at Paris in 1900 and at Buffalo in 1901.

The Rogers Railway Supply Co., Chicago.—Rogers' improved journal packing and models of Rogers' receptacle for same.

Rushmore Dynamo Co., Jersey City, N. J.—An exhibit of searchlights equipped with standard marine type mirror lenses and acetylene burners, for locomotives.

Safety Car Heating & Lighting Co., New York.—The exhibit of this company was located in the corridor of the Grand Union Hotel, and was very attractive. It included designs of gas and combination gas and electric center lamps and bracket lamps for all classes of cars. Also special fixtures for dining cars. The company had samples of its steam heating appliances, and a model of its complete water circulating system. As an object of interest, the company showed a storm proof sea lantern, such as is used on floating buoys and stationary beacons, which automatically give light at regular intervals.

Safety Train Order Signal Co., New York.—A full size model, in operation, of the Safety train order signal, as applied to a cab of a locomotive. One feature of the device is the automatic application of the air-brakes in case the engineer disregards a signal.

Scullin-Gallagher Iron & Steel Co., St. Louis, Mo.—A most interesting exhibit, and one worthy of special mention, was shown by this company. It consisted of a miscellaneous line of high grade open-hearth steel castings mostly for railroad use. Many of these castings were very difficult to make properly, a body bolster for the Northern Pacific attracting special attention on this account. The display included, in addition to several styles of body and truck bolsters, driving wheel centers, truck frames for railroad and street cars, locomotive truck center castings, locomotive steam chest castings, cross-heads and mud-rings; also a variety of gears, and numerous smaller castings.

Sherwin-Williams Paint Co., Cleveland O.—Large easels with decorated signs.

Simplex Railway Appliance Co., Chicago, Ill., and Hammond, Ind.—Full size models of Simplex 60,000 and 80,000 lbs. bolsters, and of Susemihl side bearings.

F. F. Slocomb & Co., Wilmington, Del.—Full size model of the Caskey pneumatic punch.

Smillie Coupler & Mfg. Co., Newark, N. J.—Blue prints and drawings of the Smillie coupler.

Soule Raw Hide Lined Dust Guard Co., Boston, Mass.—An exhibit of the Soule raw hide lined dust guard.

Spiral Nut Lock Co., New York.—Samples of the Spiral nut lock.

Spirittine Chemical Co., Wilmington, N. C.—Specimens of wood removed from service after having been treated with the preservative Spirittine, together with samples of the liquid used in this process of treatment.

Standard Coupler Co., New York.—An attractive booth in the court where they showed the Standard platform; types A and C Standard friction draft gear, and the Standard coupler.

Standard Paint Co., New York.—The exhibit of this company consisted of a large booth with an oak counter, on which was a model of a refrigerator car fitted with Ruberoid roofing and P. & B. waterproof paper. Samples of other P. & B. products also were shown.

Sterlingworth Railway Supply Co., Easton, Pa.—An exhibit of cars on the D. & H. tracks, consisting of one 80,000-lb. capacity low-side hopper bottom gondola structural steel car for the D., L. & W.; one 100,000-lb. capacity steel frame flat car, 40 ft. long, for the Delaware Valley; one 90,000-lb. capacity, high-side, hopper-bottom, gondola structural steel car for the Delaware Valley, weight 37,200 lbs. Also an attractive exhibit in a booth in the courtyard of the Grand Union Hotel of the Sterlingworth bolsters, trucks and the O. & C. draft rigging, tested at Purdue and Altoona.

T. H. Symington & Co., Baltimore, Md.—Dust guards and journal boxes.

Templeton, Kenly & Co., Ltd., Chicago.—Samples of the "Simplex" car jack, showing one assembled and one knocked down.

The J. S. Toppan Co., Chicago.—A small working model of a new Kennicott "Ideal" water station was shown. The novel feature of this station is the placing of the storage tank around the outside of the softening tank, thus eliminating the wooden tank. These storage tanks have a capacity of 57,000 gals., and the entire plant was designed especially for railroad service and with a view to prevention from freezing. Photographs of softening plants already installed were shown and a sectional view of an "Ideal" plant. This company also exhibited the Martin system of straight-port flexible connections for steam heat between engine and tender and complete flexible pipes with steam and air couplers for train line car equipment, eliminating hose connections between cars; also the Martin blow-off valve; and a small model of the Miller permanent grain door.

Trethewey Automatic Steam & Air Coupling Co., Montreal, Can.—Two D. & H. coaches equipped with their automatic coupling standing on the side track, to show the application of the device to passenger cars, making an automatic coupling of the steam air and air signal train pipes when the cars are brought together.

Universal Safety Tread Co., New York.—Circulars and samples of the Universal safety tread.

Walworth Mfg. Co., Boston, Mass.—An exhibit of Mack injectors; valves; steam appliances of all kinds; wrenches; die plates; vises; and the Smith friction track drill.

E. J. Ward & Co., Chicago.—"Ajax" canvas vestibule diaphragms as applied to Pullman and Gould vestibules.

Washburn Coupler Co., Minneapolis, Minn.—Exhibit of freight, passenger and pilot couplers and Washburn flexible head coupler, carriers, etc.

The Waterbury Tool Co., Waterbury, Conn.—Maker of samples of the Williams universal ratchet.

West Disinfecting Co., New York.—An exhibit of fumigating and disinfecting devices and fluids; the Sanitary formaldehyde regenerator; Taussig's electric fan air purifier; air pressure spray pump and chloro-naptholeum.

The Western Mfg. Co., Springfield, Ohio.—This company exhibited a complete and interesting line of expanding mandrels, boring and planer tools, cutting-off and threading tools. The "Champion" expanding mandrel which this company makes in sizes from ½ in. to 6½ in. has remarkable flexibility, the largest size having an expansion of 1½ in. The "Champion" tool holders are made for extremely heavy work, and are the largest and heaviest made.

Western Railway Equipment Co., St. Louis, Mo.—Combination lug and follower casting, interchangeable door, Western flush car door, slack adjuster, Downing card holder, Mudd pneumatic track sander, Linstrom non-freezing suction pipe, Acme pipe clamps, Saling metal beam, Western tandem draft lug, Western sill pockets, Linstrom eccentric, Western ball-bearing side bearing, St. Louis car door, Western bell ringer, Western truck end casting.

Western Tube Co., Kewanee, Ill.—Exhibit case of "Famous" unions, including sizes from ⅛ in. to 3 in.

Westinghouse Air Brake Co., Pittsburgh, Pa.—A large booth in the court in which they showed a repair bench for cleaning, repairing and testing triple valves and air-brake parts, two model cars on tracks showing the application and the operation of the Westinghouse automatic air and steam hose coupler, and models of the Westinghouse friction draft gear and slack adjuster for air-brakes.

Westinghouse Electric Co., Pittsburgh, Pa.—Catalogues and circulars of their railroad motors for shops.

Wheel Truing Brake Shoe Co., Detroit, Mich.—Samples of brake shoes for truing wheels without removal of car or engine from service. These shoes consist of a cast-iron frame having pockets filled with abrasive material and openings between the pockets to permit the escape of the grindings.

The White Enamel Refrigerator Co., St. Paul, Minn.—This company had on exhibition a 40-ft. Santa Fe fruit car in the D. & H. yards, showing the application of the Bohn syphon refrigerator system.

The Willmarth & Morman Co., Grand Rapids, Mich.—This company manufactures the "New Yankee" drill grinder, two of which it had on exhibition. One grinder is direct motor driven and the other belt-driven.

G. S. Wood & Co., Chicago.—"Acme" vestibule diaphragms made in types adjustable to Pullman, Gould and American Car & Foundry vestibules. These diaphragms are double stitched with wax thread and bound with leather.

Railroad Telegraph Superintendents' Convention.

The twenty-first annual meeting of the Association of Railway Telegraph Superintendents was held at Chicago, June 18, President Charles A. Annett in the chair. Fully 50 members were present when the meeting was opened, the largest attendance in the history of the association. The question of introducing typewriters into small stations for the purpose of receiving train orders elicited a lively discussion. The consensus of opinion was that the time had arrived when this valuable substitute for written train orders should be adopted. Composite circuits and the rapid development of the telephone in railroad service called forth valuable discussions.

The following were elected as officers of the association for the ensuing year: President, J. H. Jacoby, of South Bethlehem, Pa.; Vice-President, W. J. Holton, of Chicago, Ill.; Secretary and Treasurer, P. W. Drew, of Milwaukee, Wis. The morning session was largely taken up with routine matters. At the afternoon session W. J. Holton, of Chicago, read his paper on "Typewritten Train Orders." Mr. Holton said:

. . . There is nothing more legible than type. The typewriting machine has won its way from the start in every field in which the pen and pencil were heretofore used, until now it is in use in almost every office in the country. The Western Union and Postal Companies use it to the exclusion of the pen and stylus in their principal offices all over the country. These companies make it a condition that all operators applying for work in main offices must be "machine men" and must furnish their own machines. Operators, especially the younger generation, are realizing that they are not up to date unless they can operate a typewriter, and the result is that now, when operators apply for positions on our railroads, they frequently say, "I am a machine man; can take anything on a machine." Indeed, this is becoming so true that in many cases if it is necessary for a machine man to copy with a pen or stylus he cannot take a legible copy and soon tires.

The fact that much more matter can be placed without confusion in the space provided is certainly of advantage, especially in 19 orders, which are frequently used for special notices to trains. The use of the typewriter would also make it possible to put more than one movement in an order—a condition which, in the opinion of the writer, would be safer than for the crew to receive at one station four or five orders for as many movements. They are especially adapted for special schedules and work-train orders and are frequently used for that purpose in train despatching offices where there is time to prepare them in advance.

The chief difficulty in the way of using typewritten orders is the cost of a machine. It is a well-known fact that after a period of from five to eight years a person writing constantly with a pen will commence to deteriorate in legibility, and frequently he succumbs to what is known as writer's cramp; but such persons are usually valuable to a company, and if possible should be retained in the service. By the use of the typewriter this condition would be eliminated. Another difficulty is the manifold sheets with carbons. They are liable to rewind on the roller of the machine and the manifold is apt to slip so that on the under copies the letters and figures show in the wrong place. The Weeks train-order tablets, which are made to copy 3-5-7, etc., are the most convenient forms I have seen for the typewriter. These blanks have carboned backs except the bottom sheet; but more than seven copies cannot be successfully taken. And they are objected to by the trainmen, who say they cannot handle them without blacking their hands, especially in wet weather; but they are handy for the operator.

I think the best solution would be to use paper a little heavier and thicker. Have them put up in blocks of 100, same as now, and use carbon sheets between, or following out the idea of the Weeks tablet, have them manufactured in blocks of 3-5-7, etc., and put up in boxes, but instead of carbonizing the backs and folding them, leave them plain and have them fastened at the top in the same manner that message blanks are put up. It would then be a simple matter for an operator to

have a number of them already prepared by placing carbon sheets between. From seven to nine copies can be successfully taken in this manner.

When the typewriter comes into common use the style of the order blank could be changed a little. As it is now the manipulator has to do considerable changing in order to bring the number, date and address into the places provided for them. It has been said that a man is liable to make an error by striking the wrong letter; but a machine man seldom makes a mistake, and when he does he detects it just as quickly as he would if copying with a stylus. There is an objection from a legal point of view: that unless an operator copied an order autographically he could not go into court and swear that he had taken it off the wire just as it came. On this point I have the opinion of an eminent railroad attorney that a machine-copied order with the name of the receiving operator in autograph in the space provided for that purpose could not possibly be questioned.

The ideal and quickest way to secure typewritten train orders would be to buy your own machines and install them in every office on the line and require all operators to learn to use them as quickly as possible. One superintendent advocates a special size type for train-order work to be about ¼ in. square and all capitals. This I think would be the best, but not a necessary condition. The larger the type the plainer the copy and the large number of legible copies possible. A pica typewriter will not do for train-order work, as it is difficult to get more than four or five good copies, but the ordinary standard machine, such as the Remington, Smith-Premier, Oliver and Jewett, will do satisfactory work.

In the Train Dispatchers' Bulletin for March, Mr. C. A. Parker, of the D. & R. G., gives the opinions of several officials, all of which are favorable except one. Machines are in actual use only to a limited extent. I am informed that the Southern Pacific are encouraging their use by sending expert machine men along the line giving object lessons. It is all a matter of education and expense. Any road desiring their speedy adoption will have to furnish its own machines, but operators are taking to their use rapidly, and many now own machines; by placing them at principal train-order stations we can all gradually adopt them.

The points brought out in the discussion of Mr. Holton's paper were to the effect that a great improvement can be effected in legibility of copy, more matter being placed on a page; the operator's ability to receive from the wire is greatly enhanced, and the general service much improved by the use of typewriters. A motion was unanimously carried to encourage the use of typewriters for train orders.

Mr. Charles Selden moved to appoint a committee to confer with the Train Order Committee of the American Railway Association, looking to the rescinding of any rules prohibiting the use of typewriters for train-order work. Messrs. Darlton, Selden and H. V. Miller were appointed such committee.

The remainder of the afternoon session was occupied by Mr. U. J. Fry (C. M. & St. P.), of Milwaukee, who exhibited blue prints and explained the combination of a quadruplex system used on his road, a single wire being worked into one side of the same, through a Toye repeater; also a diagram of a duplex circuit was shown on which were 17 way offices cut in through that number of 150-ohm relays, the latter not disturbing the "balance" to the slightest degree. The object is for the terminal stations to utilize the circuit as a duplex when business is heavy enough to warrant it, and a way wire for the benefit of the 17 offices midway when those points have messages to transmit. The way offices open the circuit and make a prearranged signal to have the terminal points switch from duplex to single working.

The second day's session was called to order on Thursday by President Jacoby, who introduced Mr. Benson Bidwell, of Grand Rapids, Mich., who read a paper on telephoning from moving trains. Mr. Bidwell is an old-time electrical inventor, and in the early days of the telegraph he was an associate of Professor Morse. He gave some interesting reminiscences of his experience in the early days of the telegraph and before, when Professor Morse, in traveling about the country to arouse interest in his invention, came to Adrian, Mich. (1842). Mr. Bidwell has made experiments in electric propulsion since 1884, when he had to do with the running of the first trolley car, which was at the Philadelphia Electrical Exhibition. He proposes to communicate by telephone between a station and moving trains by means of an overhead wire and a trolley, making the connection in the same way as for propulsion. He has made experiments at Muskegon and at Grand Rapids, Mich., on street cars.

Mr. C. A. Annett followed Mr. Bidwell with a detailed description of the extensive telephone system in use on the Illinois Central Railroad. The remainder of the session was devoted to telephone discussion, many valuable points being brought out. Mr. L. B. Foley, of New York, Superintendent of Telegraph of the Delaware, Lackawanna & Western, said that in connection with his telephone system, owned and used by the railroad company, arrangements had been made with the Bell Telephone Company for the installation of public telephones in the railroad stations, with the result that the railroad's share of the revenue is sufficient to return to the company 5 per cent. interest on the amount invested in its telephone property.

There was a session on Friday from 9 a. m. to 1 p. m. A resolution was adopted ordering an amendment to the constitution permitting electrical supply people and those engaged in kindred interests to become associate members of the association. The proposed amendment will be reported at the next annual meeting. Such members will have all the privileges of active members except that of voting. The dues for associate members will be $5 a year.

Mr. O. C. Greene, of the Northern Pacific, explained the metallic telephone system in use on his road, whereby telephone circuits are obtained over ordinary telegraph wires without the telegraph being interfered with.

Mr. C. S. Rhoads (C., C., C. & St. L.), chairman of the Committee on Universal Code, reported that the matter should be taken up with the American Railway Association, whose support should be obtained in the preparation of a universal code for general railroad service.

The subject of overhead wires at railroad crossings caused considerable discussion, and the secretary was instructed to incorporate in the printed proceedings of the meeting the laws governing such crossings, which have been enacted within the past few years by the States of Indiana, Ohio and Missouri.

Mr. J. J. Nate, of the Stromberg-Carlson Telephone Company, Chicago, was called upon to address the assemblage on telephones and their uses in connection with the railroad service. Mr. Nate is a pioneer telephone manufacturer, and gave the members valuable points.

NOTES AND EXHIBITS.

Messrs. Charles McLoughlin and V. C. Grace represented J. H. Bunnell & Co., of 20 Park Place, New York. A full line of modern telegraph instruments was displayed.

The Bunnell Telegraphic & Electrical Company, of New York, was represented by H. S. Young, Jr., and Jesse H. Bunnell. Samples of their telegraph instruments were shown.

Wyckoff, Seamans & Benedict (Remington typewriter) were represented by D. E. Carpenter, the Chicago manager, and Charles A. Middendorf, an expert typewriting operator whose typewriting work was favorably commented upon by all.

The Safety Insulated Wire & Cable Company, of New York, was represented by Avery P. Eckert.

The Crocker-Wheeler Company, of Ampere, N. J., was represented by F. M. Holbrook, E. E., the Chicago representative, who distributed pamphlets of motor-dynamos and dynamotors for telephone and telegraph plants.

The National Conduit & Cable Company, of New York, was represented by W. S. Eckert, of New York.

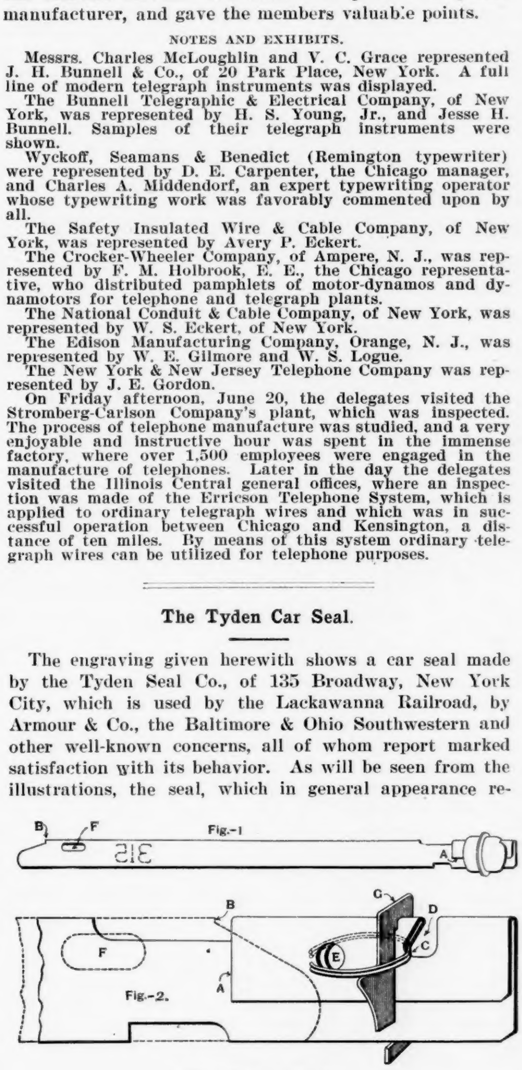
The Edison Manufacturing Company, Orange, N. J., was represented by W. E. Gilmore and W. S. Logue.

The New York & New Jersey Telephone Company was represented by J. E. Gordon.

On Friday afternoon, June 20, the delegates visited the Stromberg-Carlson Company's plant, which was inspected. The process of telephone manufacture was studied, and a very enjoyable and instructive hour was spent in the immense factory, where over 1,500 employees were engaged in the manufacture of telephones. Later in the day the delegates visited the Illinois Central general offices, where an inspection was made of the Erricson Telephone System, which is applied to ordinary telegraph wires and which was in successful operation between Chicago and Kensington, a distance of ten miles. By means of this system ordinary telegraph wires can be utilized for telephone purposes.

The Tyden Car Seal.

The engraving given herewith shows a car seal made by the Tyden Seal Co., of 135 Broadway, New York City, which is used by the Lackawanna Railroad, by Armour & Co., the Baltimore & Ohio Southwestern and other well-known concerns, all of whom report marked satisfaction with its behavior. As will be seen from the illustrations, the seal, which in general appearance re-



The Tyden Seal.

In Fig. 2 the dotted lines at B, F, etc., represent the left-hand end of the tin, bent and brought over and thrust behind the fold A.

sembles the ordinary tin seal, is not a seal in the sense of an imprint on soft metal, but is an automatic lock, which, when locked, cannot be unlocked without breaking the globular metal cap which covers the locking parts.

Fig. 1 shows the seal complete, before use. The locking device is concealed in the globular tin cap at the right-hand end. Fig. 2 shows this right-hand end with the cap taken off. To use the seal the left-hand end (Fig. 1) is bent over and pushed in, at A, into the space between the folds of metal. The end of the tin, B, pushes the rings at C, lifting them up out of the recess D, and, at the same time, the ends of the rings, before held apart by the body of the seal are snapped into the hole E. Before the rings reach this position slot F registers with E, so that the rings thus lock the two ends of the seal together. These rings are made of steel piano wire. As the seals leave the shop the rings are in the position shown in Fig. 2, each ring being held open a space equal to the thickness of the double tin. As soon as they are pushed along so as to have this barrier removed the ends snap together; but the ends do not abut one against the other; they overlap, the normal shape of the ring being such that these ends overlap about $^1/_{16}$ in. In the new position the rings (or one ring) will lock the two ends of the seal together, so that the movable end cannot be pulled out. The guard G, holding the rings in position, is itself held in position by the cap and by a slot in the tin.

Among the names reported as using these seals are the following: New Orleans & Northwestern Ry. Co., Delaware, Lackawanna & Western; United States Express Co., Los Angeles Terminal Ry., Pillsbury-Washburn F. M. Co., Minneapolis; Arkansas Midland Railway, Chicago Junction Ry., the Pullman Co., Armour & Co., Chicago, Ill.; Louisville, Henderson & St. L. Ry.; Midland Terminal Ry., Cleveland, Lorain & Wheeling R. R.; Tennessee Central Ry., Rock Island & Peoria R. R.; Chicago & Western Indiana R. R.; Ohio River R. R., Baltimore & Ohio Southwestern R. R., Buffalo, Rochester & Pittsburgh Ry. There are also 31 flour shippers of Minneapolis and 27 United States Government Inspectors' offices.

The Train Dispatchers' Convention.

The 15th annual convention of the Train Dispatchers' Association of America was held at Pittsburgh, Pa., June 17, Mr. J. R. Lusk, Assistant Superintendent of the Baltimore & Ohio at New Castle, Pa., of the local committee and former president of the Association, in the chair. The proceedings were opened with an invocation by the Rev. T. J. Leak, after which the Hon. A. C. Robertson, representing the city of Pittsburgh, and Mr. J. B. Yohe, General Superintendent of the Pittsburgh & Lake Erie, representing the railroad men of Pittsburgh, welcomed the convention. Mr. J. F. Mackie, Secretary-Treasurer and Editor of the Association, responded. A large number of Pittsburgh dispatchers and ladies were present to assist in the welcome. Mr. Robert Pitcairn, Assistant to the President of the Pennsylvania R. R. and Chairman of the Train Rules Committee of the American Railway Association was also present during the recess following the opening ceremonies.

In the absence of the President and Vice-President, Mr. A. D. Caulfield, senior member of the Executive Committee, was elected to preside.

The annual address of the absent President was read and referred to the usual committee. Thirty-three members were elected and one reinstated by ballot.

The reports of the Executive Committee, including the annual report of the Secretary-Treasurer and Editor and of the publisher of the official organ, were read and referred to the same committee as the President's address. This report showed an increased membership over the previous year of 153, bringing the total membership up to 751 and a balance on hand in the treasury of $796. The Secretary's report discussed, the question of transportation to future conventions, emphasizing the importance to the Association of demonstrating the value to the railway service of its annual meetings and the necessity of convincing railroad management of this, as the first step to be taken towards the obtaining of transportation privileges. It also urged an appropriation from the general fund for the enlargement of the official organ. The publisher's report showed a considerable increase in the circulation of the official organ, the *Train Dispatchers' Bulletin*, and, for the first year since its publication, a profit to the Association from this source.

The report of the Train Rules Committee recommended the addition of another example to Form E, for submission to the American Railway Association, permitting the issue of this form (an amplification of the present Example 3) without reference to opposing inferior trains, as being, in some cases, superior to the present Example 2 in usefulness, clearness and consequent safety. The committee were unable to meet during the year and therefore unable to reach conclusions upon other questions before them.

Papers were read on "Defective Train Dispatching," by Mr. H. A. Dalby (C., R. I. & P.), Fairbury, Neb.; on "The Positive Meet," by Mr. E. M. Woodruff (N. Y., N. H. & H.), Providence, R. I.; on "The Train Dispatcher," by Mr. S. H. Brown (C. & A.), Kansas City, and on "Form F," by Mr. John F. Mackie (C., R. I. & P.), Chicago, which were more or less discussed.

The convention adopted an amendment to the constitution permitting the indorsement of applications by one member and the chief dispatcher, trainmaster or superintendent under whom an applicant is serving, and also an amendment to the preamble of the constitution, forbidding the consideration by the Association of questions of hours worked, wages received by or conditions of service required of its members, thereby crystallizing into organic law what has been the fixed policy of the Association for the past eight years. It also ordered the enlargement of the official organ to 32 pages of reading matter per month, without increase in price of subscription.

The election of officers for the ensuing year resulted in the election of the following: President, A. D. Caulfield (Illinois Central), Wilson, La.; Vice-President, F. S. Rogers (B. & O.), Pittsburgh, Pa.; Secretary-Treasurer-Editor, John F. Mackie (C., R. I. & P.), Chicago, Ill. Mr. J. B. Yohe, Mr. Robert Pitcairn and Mr. Andrew Carnegie were elected honorary members. Nashville, Tenn., June 16, 1903, were selected as place and time of the next annual meeting.

The convention found Pittsburgh overflowingly hospitable. The feature of the entertainment was a visit, by special train of the Pittsburgh & Lake Erie, over the tracks of that and the Pennsylvania Railroad, to the Carnegie Steel Works at Homestead, the Bessemer Furnaces, the Westinghouse Air-Brake and Electrical works, and the Union Switch & Signal plant, the inspection of which was immensely interesting and instructive.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

From press despatches it seems possible that Senator Morgan will subside and accept the decision of his fellow members of the Senate in favor of the Panama route for the Isthmian canal. This would be one of the most reasonable and dignified acts of his career. He has been persistent and even stubborn, and must have pleased his constituents and clients. Doubtless, he and his constituents believed and still believe that Mobile would be benefited by the canal over the Nicaragua route more than by the Panama route. But Mr. Morgan's stubbornness has been one of the most serious obstacles in the way of the canal project. He has always stood against any deliberate study, has always opposed the appointment of a commission and has always tried to force through the Nicaragua bill against the judgment of men just as honest as he is, and more intelligent. This uncompromising attitude has delayed the project for years. This, however, has not been a misfortune; on the other hand, it has been a great piece of good fortune, for it has resulted in revisions of dimensions and of estimates of cost which will insure a canal capable of passing the ships of the present day. Since Mr. Morgan undertook to have a bill passed based on the estimates of a group of speculators, those estimates have been more than doubled, and the dimensions of the canal prism and of the locks have been increased, so that the canal could now pass the largest ships, which it could not do had it been built on the early plans.

The per diem agreement now has 216 signers, and these represent over 1,437,000 cars. The most prominent company among the recent signers is the Chicago, Milwaukee & St. Paul. The Nashville, Chattanooga & St. Louis, and some other roads in the South, have signed. The signature of the last-named would seem to indicate the friendly co-operation of the Louisville & Nashville, as the road is controlled by the L. & N.; though at last accounts the latter was proposing to "support" the movement without binding itself by signing the one-year contract. The most business-like action that we have heard of in connection with the change which is to take place on July 1 is the announcement of the Grand Rapids & Indiana that it is going to increase switching rates a dollar on each car. This is tackling the problem at the right end. The traffic men have handled questions of this kind from the wrong end for so many years that they are perhaps excusable for continuing to do so, from mere force of habit; but there is no reason why transportation officers should follow in their footsteps. If the fear of your competitors is the sole basis, year in and year out, on which rates are to be based, it is probably right to "absorb" every new expense that has to be added to the cost of the service rendered to a shipper or consignee; but it is to be hoped—and there begin to appear grounds for hope, here and there—that "community of interest" is going to abate this blind fear somewhat. When a reasonable occasion arises for advancing the price to be demanded for doing a service at a competitive point, why not follow the dictates of reason, and surprise your competitor by advancing it? Your sane action may arouse him to sanity. If he shall hear thee, thou hast gained thy brother.

The discussion of the strike of the anthracite coal miners has brought out a repetition of the old claim that the rates charged by the railroads for carrying this coal are exorbitant in themselves, and also that they are too high in proportion to what is usually asked for carrying bituminous coal. Most people find it so hard to see any difference in the cost of service that the assertion that no difference exists goes without challenge. The first part of this question it would perhaps be profitless to discuss at this time; but the comparison with bituminous rates is so universally offered in apparent ignorance of the facts that it seems worth while to again call attention to them. They were clearly set forth in the Coxe Brothers suit; but that suit has almost taken its place as ancient history. In the first place the anthracite coal region is geologically a broken country. To reach the mines expensive lateral railroads have had to be built. These lines have very steep grades, so that both maintenance and operation are expensive. Some, indeed, of the bituminous coal fields are in mountainous regions, but, on the other hand, many of these fields have been reached by railroads of moderate cost. The distribution of the two kinds of coal is quite different. Bituminous is usually sold in large quantities, to manufacturers and to the steamship trade; and contracts are made for a year at a time. The coal is sent in full trainloads to one destination, and the cars are unloaded promptly. Anthracite, used mostly for domestic purposes, can, indeed, be shipped for a part of the distance from the mines in trainloads, but a single train will contain half a dozen different sizes of coal consigned to many different persons. Bituminous coal on any given railroad is practically of the same quality. This necessary difference in treatment involves detention of cars and much additional switching. Probably the average detention of cars is many days more with anthracite than with bituminous. The Reading road, for instance, has 40 or 50 freight stations in Philadelphia, and it is a matter of common observation that coal for domestic uses is delivered at many of these stations and at many retail coal yards besides. With coal, as with other bulk freight, retail receivers now demand that cars shall be delivered to them only about as fast as they want them; and, if this means only one car at a time, the railroad company usually has to submit. Moreover, anthracite not only comes in different sizes, but there is a difference in quality, as for example, red ash and white ash. The different kinds must, of course, be kept separate one from another. It is only at the very largest yards, such as the great deep water terminals at Philadelphia and New York harbor, that any considerable quantity of particular sizes and kinds can be kept on hand.

All the foregoing considerations directly affect the cost of the service. In addition, there may be, and often is, a legitimate difference in the rate on coal due to the needs of an industry, or of a city or district. One of the most common and most useful services that have been rendered to the public by railroads has been the promotion of new industries, and one of the most directly beneficial means adopted for this purpose has been the granting of a special low rate on bituminous coal for manufacturing. Unfortunately the railroad which employs this expedient is pretty sure to hear, very soon, from some legislator or public official, that the low rate thus granted at a present loss and for the sake of a future gain, has demonstrated that the same railroad may be fairly asked to carry all goods of similar weight, bulk and value at the same low rates. The friend of the people very quickly adopts, and never modifies, the doctrine that when a railroad makes a rate voluntarily, that rate is thereby conclusively proved to be reasonable, forever; and not only this; it is also believed, and loudly declared, that the *rate of profit* accepted in granting this low rate is one which the carrier should thenceforth cheerfully accept on all of his business, of whatever kind. This attitude on the part of or in behalf of the public forces the railroad officer to make prominent the opposite view; the view that the carrying of coal or raw materials at very low rates rather affords justification for charging higher rates on those other commodities which can bear higher rates. Indeed, it seems quite likely that the theory which the railroads ought to adopt as the most rational for the justification of their coal rates would be that the anthracite rates are the nearest to the normal standard, and that those on bituminous have been abnormally reduced. At all events a legislature or other public authority is in reason bound, in any action which it may take in the regulation of transportation rates, to consider the whole question, and not merely the effect of competition, whether competition of commodities or of mines or of markets.

The Steel Trust Decision.

The decision of Vice Chancellor Emery of New Jersey, in the suit of Berger against the United States Steel Corporation, makes a landmark in the development of the law of corporations.

Mr. Berger is a holder of preferred stock in the corporation and as such he brought suit to restrain the corporation from carrying out the plan of retiring $200,000,000 of the preferred stock and issuing bonds therefor. Pending the trial of the action, which under the slow process of an equity suit in New Jersey, would not take place for months to come, the complainant made a motion before the Vice Chancellor for a preliminary injunction to restrain the consummation of the scheme before a trial could be had. A preliminary injunction is not usually a decision upon the merits, and ordinarily signifies only that the plaintiff has made such a case in the outset as to entitle him to an order that the defendant proceed no further in the course objected to until a complete investigation of the facts be had at the trial. It frequently happens that the trial shows that the plaintiff is either wrong on the facts or in his view of the law applicable to them, and in such cases the preliminary injunction is set aside. When, however, the sole object of the suit is to obtain an injunction against a threatened act, the Courts are slower to grant injunctions upon mere motions far in advance of that more careful inquiry into the rights of the parties, which a trial is supposed to make. A preliminary injunction in an action when injunctive relief is merely incidental to the main relief, is, therefore, by no means conclusive that the plaintiff will finally succeed. But where the sole object of the suit is an injunction, and nothing or little else, its issue at the threshold of the litigation may be usually taken as the deliberate opinion of the Court that the plaintiff is entitled to succeed in his case.

Such is the effect of the decision of the Vice Chancellor in Mr. Berger's suit. The Court has gone deliberately into the facts of the case, and having filed its opinion after careful consideration, there is nothing for the Steel Corporation to do but to appeal. This, we understand, it has done, and steps have been taken to bring on the appeal at an early day before the Court of last resort in New Jersey.

The case is interesting because novel in its bearings; and important, not only because it affects an issue of $200,000,000 in bonds, but especially because it seriously disturbs an elaborate financial arrangement of unusual proportions, in which many interests are involved.

Of the total authorized capital of this corporation amounting to eleven hundred million dollars, $550,000,000, or one-half, was preferred stock, and the residue was common stock. The holders of preferred stock were preferred, not only as to dividends, but also, upon the dissolution of the corporation, in the distribution of its assets. A yearly dividend of 7 per cent. must be paid on the preferred stock before any dividend whatever can be declared on the common. And on the winding up of the corporation, the preferred stockholder must be paid the full par value of his stock as well as all unpaid annual dividends before the holder of common stock can be paid anything at all. The charter further provides that the real property of the corporation should not be mortgaged without the consent of the holders of at least two-thirds of the capital stock. There was nothing in the charter authorizing the retirement of the preferred stock, or any part of it, and issuing bonds for it.

Nor, at the time of the issue of the stock of the corporation was there any law in New Jersey allowing the substitution of bonds for preferred stock. But in March of this year, and, of course, after the organization of the Steel Corporation and the issue of all its preferred stock, the legislature of New Jersey passed a law authorizing a corporation, with the consent of two-thirds in interest of each class of the stockholders, present in person or by proxy, at a duly called meeting, to retire the preferred stock of any stockholder, upon his consent, by paying him

in bonds, or with the proceeds of bonds, of the corporation.

Shortly after the passage of this law, the Steel Corporation obtained the consent of two-thirds in interest of each class of its stockholders, to retire $200,000,000 of its preferred stock and issue therefor an equal amount of the bonds of the corporation. As there were consenting stockholders enough to take the entire issue of bonds on this basis, the success of the scheme was assured, had no preferred stockholder objected. But Mr. Berger was a preferred stockholder, and he did object.

To understand the force of this objection as well as to determine its validity, it is necessary to know the effect of the scheme in question upon the original contract which the subscriber of preferred stock made with the corporation when he agreed to take the stock. This contract includes not only those express provisions of the charter of the corporation which define the rights attached to this class of stock, but also those provisions of the law of the state of incorporation, which regulate the issue of stock and determine the rights and obligations of stockholders, not only as between themselves but also as between themselves and the state, and between themselves and creditors of the corporation. Not to go too much into details, we may say that it is a fundamental provision of every such contract that the capital of the corporation is a trust fund for the benefit of its creditors first, and then, after they are paid in full, for the benefit of its stockholders, according to the special lawful agreement that they have made among themselves. This provision adheres to every share of the stock from the moment of its creation, and remains, as a right as well as an obligation, to the moment of its extinguishment in the lawful dissolution of the corporation. No act of the board of directors can impair this right, or destroy this obligation, against the will of those interested in preserving it intact. For these are matters of contract, and under our system of government contracts cannot be impaired, even by the Legislature itself.

Now the contract that Mr. Berger made with the Steel Corporation and the other stockholders, when he acquired his preferred stock, was in substance that, after creditors were paid in full, he should receive, *pari passu* with all other preferred stockholders, the full par value of his stock, or as much thereof as the assets of the corporation on dissolution would allow of, together, of course, with all unpaid annual dividends at the rate of 7 per cent. per annum. In other words, it was agreed by this contract that no preferred stockholder should receive more than Mr. Berger himself, and that all should be treated alike. This meant, among other things, that the capital of the corporation should not be distributed among favored preferred stockholders, before the period of distribution arrived, as fixed by the contract as well as by law.

What, now, was the scheme of the directors? It was in substance, to retire $200,000,000 of the $550,000,000 of the preferred stock and issue therefor $200,000,000 of bonds. That is to say, they proposed to transmute nearly one-third of the preferred stock into an equal amount of bonds, or in other words, to change stockholders, owning nearly one-third of the preferred stock, into creditors of the corporation to an equal extent. So that, if the scheme should go through, Mr. Berger would find that, instead of being, upon the dissolution of the corporation, on a level with all other holders of preferred stock, as was agreed, some of them, by a magical change from stockholders to bondholders, have a preference over him and others, not so changed into creditors, in the distribution of the capital, and that such preference amounts to the considerable sum of $200,000,000.

This scheme undoubtedly impairs the rights of Mr. Berger in his contract of subscription, and he has brought his action to prevent its consummation.

But the directors make answer that the statute of March, 1902, allows them to do this otherwise objectionable thing. They also claim that it is, on the whole, a wise plan for the corporation to carry out, and has the sanction of all the stockholders of the company, excepting an inconsiderable minority. This is a formidable answer, and to overcome it, Mr. Berger was obliged to attack the validity of the law in question. The issues before the Vice Chancellor were, therefore, first, one of fact: does the scheme really involve a preference in the distribution of the capital of the corporation, to the prejudice of Mr. Berger's rights? and secondly, is the law authorizing the plan, if found to be a preference, constitutional?

The Vice Chancellor finds both of these issues in favor of Mr. Berger. Upon the first point we think he is clearly right. Any plan which changes a stockholder of a corporation into a creditor gives him a preferential interest in the capital, and anticipates the period of distribution at the moment that it grants the preference. It seems to follow from this, with equal clearness, that the law of March, 1902, passed after the contract of subscription with Mr. Berger was made, could not operate to impair the least of his rights. For it had upon it the ban of the Constitution of the United States, that no state shall ever pass any law impairing the obligation of contracts.

It is no answer to all this to say that Mr. Berger does not know a good thing when he sees it; nor to charge him with acting against the best interests of the corporation, and therefore, as a stockholder, against his own best interests. It is a cherished privilege, solemnly guaranteed to every American citizen, and frequently enjoyed, to act unwisely or even foolishly, when dealing with his own rights. And this great satisfaction none of us wish to see taken away from any one in this country, and, leastwise, from ourselves.

This complainant may or may not be acting in the way that those act who heap up great riches for themselves in this world; but he seems to know quite accurately what his rights are, and to be quite determined to stand by them. We shall watch the further progress of this case with that interest which a prophet shows in the fulfillment of his prophecy; and, we may add, with a prayer, for the reasons stated, that we shall not prove to be mistaken.

The regulations for the prevention of accidents to English railroad employees, which were promulgated by the Board of Trade many months ago and which, after some modifications, have been accepted by most of the railroads of the United Kingdom, have lately been contested in one or two points. The Taff Vale and two other roads in Wales complain of the rule requiring a caboose on all freight trains, and they took their complaint to the Railway and Canal Commissioners. This Commission refused to amend the rule, but it is said that the Board of Trade will, in consequence of the protest, be lenient in enforcing it. The London & North Western and other roads have represented that the rule requiring brake levers (for hand brakes) on both sides of freight cars ought not to be applied to the new long freight cars which have lately been put in use to a considerable extent on several roads. The Board of Trade will probably modify the rule so as to except such cars. With the changes here noted it is expected that the Code of Rules as a whole will be put in force at once.

In all respects the annual meetings of the Master Car Builders' and the Master Mechanics' associations were most successful. The weather was cool and delightful, the attendance fully as large as in any years previous, the meetings of the associations were conducted in a business-like way and the exhibits, as usual, were numerous, interesting and instructive. All this confirms the opinion already expressed, that it seems useless to try to find a better location for holding these important conventions. Saratoga is admirably equipped for taking care of a large gathering within a comparatively small area, and the attractions are just sufficient to insure enjoyment without taking members and guests away from the center of business. The hotels, particularly the two between which the greater part of the patronage is divided, have shown a disposition to deal fairly with their guests. This year's expenditures by the Entertainment Committees were about the same as in recent years; that is, in the neighborhood of $6,000, the two principal items being for a band and carriage hire.

TRADE CATALOGUES.

The Buckeye Malleable Iron & Coupler Co., Columbus, Ohio, have issued an attractive special catalogue describing the Major Coupler, a new form of M. C. B. coupler which they are putting on the market. This coupler is designed especially for the heaviest service, is simple in construction and positive in action. It combines in its mechanical features, automatic positive knuckle throwing, a lock set within the head, protection of the pivot pin against excessive shocks in buffing and pulling, and an ample locking surface. It has a knuckle face of 10 in. and the shank is made in three sizes, 5 in. x 5 in., 6 in. x 6 in. and 5 in. x 7 in., made in either cast-steel or malleable iron.

The J. G. Brill Company, Philadelphia, Pa., has just issued a little catalogue illustrating and describing the various features of its No. 27 steam and electric truck. The half-tones are especially clear. A number of testimonials from users of the truck are given, and the book closes with a list of roads using the device.

Motor Driven Tools is the title of Bulletin No. 24, just issued by the Crocker-Wheeler Co., of Ampere, N. J. The catalogue gives a good idea of the progress which has been made by this company in the application of its motors to machine tools. The book contains 25 pages of well selected views which show the variety of purposes to which the electric motor is adapted. Of especial interest to our readers will be the illustration of a 100-in. locomotive wheel lathe electrically driven. The whole book is handsomely printed and is bound in an attractive burlap cover.

The M. C. B. Convention.

(*Continued from page 505.*)

draft gear should act. If we wish to determine the action of a draft gear in a wreck or at the speed of 30 miles an hour, we could form some idea of this action by the drop test. A weight falling from a distance of 30 ft. at the time it strikes, is traveling at approximately 30 miles an hour, some 40 odd feet per second. That certainly does not present conditions under which we wish to arrive at the service or benefits of a given design of draft rigging. I doubt very much if we should draw conclusions from this drop test. It is very unfortunate that the committee did not give us some conclusions or deductions or inferences, at least, to be discussed.

Another feature which it occurs to me we should not be in too great a hurry in drawing conclusions from in the drop tests is the extent of the rebound. If I understand the matter properly, the great advantage of the friction gear is that it will absorb shocks. These shocks are not at the rate of 30 miles an hour, but in ordinary service conditions. The friction draft gear is of relatively little use unless it has time in which to act. If a blow is struck at the rate of 30 miles an hour it certainly has not the time in which to act as it would under service conditions, in making up trains, in starting trains or in running through sags.

Another point is the rebound as shown by the drop test. It occurs to me, that because of the speed at which the blow is struck, these drop tests are probably not safe to draw conclusions from, as I believe if the matter is analyzed a little it will appear to you, as it does to me, that the rebound is simply a measure of the capacity of the preliminary springs in the friction draft gear.

Mr. W. E. Fowler (N.-C.-O.)—The conditions for entering tests, or at least a part of them, say that each print is to bear the trade classification or mark by which that particular draft gear is known, and to also show of what materials the different parts are made; also to show whether the rigging is one in regular service on cars, or whether it is an experimental rigging, made for test purposes. Now referring to page 56, I find that the Miner draft rigging is the only one with the names of companies upon which any service is given, and I merely wanted to know whether or not this was a matter of advertising for Mr. Miner, or were the other draft gears not in service, but were they merely made for experimental purposes. This information is not given.

Mr. J. T. Chamberlain—I want to call the attention of the Convention to the circular which was sent to the draft rigging manufacturers by the M. C. B. draft gear committee. It states as follows: "These tests are expected to show the efficiency of the different draft riggings and their relative standing under shocks and under steady pulls."

The circular further states that each print of test draft gears submitted for test purposes must bear the trade classification or mark by which that particular gear is known, and also show of what materials the different parts are made; also to show whether the rigging is one in *regular service on cars* or whether it is an experimental rigging made for test purposes.

It will be noted that only one manufacturer has shown what railroads are using the particular types of draft gear he submitted for test. It is, therefore, evidence that the other draft gear manufacturers submitted specially prepared test gears which do not represent accurately the construction they use for cars in regular service. In other words, they submitted draft gears especially designed to make a good showing under the tests. As I understand the matter this practically nullifies the efforts of the committee, as they especially desired to show by means of these tests the actual performance and strength of draft gears now in extensive service. I would like to ask for data showing whether or not most of the draft gear manufacturers substituted cast-steel parts for their usual malleable-iron parts; also whether they did not use wrought-iron forged draft lugs instead of the usual malleable lugs. I am informed that extra heavy forgings were used in many instances; for example, drawbar yokes made of wrought-iron, 1½ x 5 in. instead of the usual section, and if this was done, report of the test should plainly show the size of material of each detail of the specially designed test gears so that it will not be misleading. I am informed that some of the draft gear submitted to the committee for test would cost upwards of $100 to apply to cars, and we could get no information from such construction.

Mr. Lawes—In regard to the materials used in the construction of the draft gear to be tested, the manufacturers furnished the committee nine blue prints of each kind of draft gear showing the construction and the materials from which it is made. As the evolution of the draft gear continues from day to day, you cannot say to-morrow what the draft gears will be, as compared with what they are to-day.

Mr. Sanderson—We test axles with the drop test. I don't think any one will maintain that the conditions in the drop testing of axles are similar to the service conditions of axles; but the drop testing of the axle is considered the best known means of bringing out the quality of the axle for subsequently standing service strains. I do not think these drop tests are, properly speaking, tests which will show up the power of the draft gears under service conditions at all, but they are, I believe, a fairly good measure of the strength of the parts of the draft gear in the matter of detailed design to stand punishment in connection with the pulling tests.

Whether the draft gear as a whole is properly constructed to give what we want in the way of the most efficient draft gear is another question. That must be worked out in some manner. I believe it can be done preferably by service tests.

Mr. Quereau—I agree with Mr. Sanderson, saying nothing about the expense or how it shall be worked out, that the ultimate tests will be the results in service. Whether it will pay to equip a train of 50 cars with draft gears of different designs, as was done with the air-brakes, I am not prepared to say, but that must be the ultimate test. I think the Association and the railroad world at large will admit that the cost of the air-brake test in service has been amply repaid again and again. I am not prepared to say it would be true with draft gears, but that must be the ultimate solution of the problem.

Mr. Charles Streicher (Central R. R. of N. J.)—I have come to the conclusion that there is no other subject that deserves the attention of the Association more than the proper design and application of a draft gear that will stand the requirements of the present service. I think the draft gears working on the friction principle must be considerably simplified before they can meet the requirements of actual service. What I mean to say is this—while the friction principle is a correct one, I wish to impress on the parties working on that line that they must simplify the parts. They cost too much money to permit the average company putting them on cars of less than 80,000 lbs. capacity. While the report as published contains considerable information, it is not clear enough to offer suggestions to the practical men in service. It does not give us any lines on which we should work in order to improve the gears that we have at present to contend with.

Mr. Waitt—I was very much pleased at reading the report. In the appointment of the committee on this subject it was intended that it should do everything possible to develop the state of the art and improvement in draft gears, not simply to find out which is the best draft gear in the market, but the committee has a large problem on its hands, and it is quite difficult to find either the railroad representatives or the manufacturers of draft gear ready to suggest just how the tests ought to be conducted. If I remember correctly the action taken at the meeting in Chicago, it was not the intention of the committee at all to confine the tests made simply to the construction that was then being put out by the manufacturers, but in view of the fact that we were going to have a great many cars of 50 tons capacity in the future, the idea was to give the manufacturers and others an opportunity to develop and strengthen as far as they saw fit, the various types of draft gear they manufacture. I think that result has been accomplished. The committee has shown results so far as it has gone. It has not attempted to draw conclusions, because it is altogether too early to wisely draw any final conclusions. The committee says that it has a great deal of work ahead, and I believe that we should encourage the work on the line taken up and on the lines suggested in the report; and I move the commendation of the Association be given to the committee on its work so far, and that the committee be continued and instructed to carry out the work of further tests on the lines they have suggested. Also that the thanks of the Association be tendered to the railroad companies, to Purdue University and to the gentlemen mentioned in the last paragraph of the report, who have given special aid to the committee in its work.

Motion was carried.

The President—Mr. Quereau will make a report on the subject of Additional Labor Prices in Cleaning Air-Brakes.

STANDARD METHODS OF CLEANING AIR-BRAKES AND ADDITIONAL PRICES FOR LABOR AND MATERIAL.

[*See the Railroad Gazette, June 20, page 457.*]

Mr. Quereau—At the suggestion of this Association, the Committee from the Air-Brake Association and the Committee from the M. C. B. Association met and somewhat modified the original report of the M. C. B. Association Committee, but only to the extent of making the report more complete. There is no essential difference between the report as it is now drawn up and as presented to the Association. It is not to be adopted as a standard; it is simply suggested as recommended practice. (Sent to letter ballot as Recommended Practice.)

The President—The next report is that of the Committee on Side Bearings and Center Plates.

SIDE BEARINGS AND CENTER PLATES.

[*See the Railroad Gazette, June 20, page 470.*]

Mr. Haskell presented the report and asked that the committee be continued for another year. (Carried.)

The President—The next report is that of the Committee on Indexing the Proceedings.

INDEXING THE PROCEEDINGS.

The Secretary—The committee hopes in the course of two weeks to have the index ready for distribution. The committee will also have prepared, separately, a digest of the decisions of the Arbitration Committee.

The Secretary then read the report of the Committee on Cast-Iron Wheels.

CAST-IRON WHEELS.

Owing to circumstances over which it had no control, the committee was not able to get satisfactory information on the subject. This is particularly the case with reference to the wheels for cars of heavy capacity; in fact, the information on this subject is, so far, quite indefinite and fragmentary.

The practice for weights of wheels under 100,000-lbs. capacity cars varies from a minimum of 630 lbs. to a maximum of 750 lbs. As there seems to be a great discrepancy in this respect, the committee considers the matter of sufficient importance to recommend the continuance of the committee for the coming year.

The question of recommending minimum weights of wheels for different classes of cars, so that at interchange points, if the wheels do not meet these figures, the cars may be refused, is one which is very difficult to deal with. If one railroad company, in order to avoid undue weight of wheels, goes to the expense of using high-priced material, it would be an injustice to it to put it on the same footing as in the case of the use of wheels of miscellaneous and undefined mixture of metal, and these railroads would be put in an undesirable situation by making a high maximum. Making a low maximum weight, that is not safe for some metals frequently used in wheels would leave railroad companies without proper protection.

The committee is inclined to think that the majority of railroad companies are necessarily compelled to go to the weight of wheels which gives satisfactory service on their own line, and believes that if a rule were made to prevent putting wheels of less than a given weight on certain capacity foreign cars, the interchange requirements would be as closely met as it is practicable to do at the present time.

As far as the weight of wheels for different capacity cars is concerned, there are indications that the recommendations made by the committee at the last meeting are below that called for by the general feeling. This is one of the most important matters before the Association; with the development and manufacture of larger capacity cars the circumstances are shifting rapidly, and the committee recommends that the subject be continued for another year.

In conclusion, your committee would recommend that a careful record be kept by the members for the purpose of furnishing information to this Association of all cases of breakage of wheels, giving the following information:

1. Weight of wheel.
2. Capacity of car.
3. Character of breakage.
4. Track circumstances as far as the grade is concerned; that is, whether the breakage occurred on a grade or near the terminus of a grade of a given length. If any grades are found specially troublesome, a plan showing profile and curvature would be especially valuable. The terms descriptive of breakages should conform, as far as possible, with the terms adopted by this Association.

This report is signed by Messrs. J. N. Barr (Chairman), Wm. Garstang, J. J. Hennessey, D. F. Crawford, Wm. Apps.

DISCUSSION.

Mr. George L. Fowler—About a year ago I had occasion to investigate the subject of cast-iron wheels under cars of 80,000 lbs. capacity. The reports which I obtained from Superintendents of Motive Power of different roads were as various and widely separated as the men from whom they were obtained. The failures were circumferential cracks running along on the flange and the flange gave way. That has been modified by an addition to the weight of the wheel by thickening the plate somewhat and carrying the bracket out a little further so that instead of having an undercut beneath the flange, it is brought out perfectly straight or even given a little swell. These wheels are apparently giving perfectly satisfactory service, few breakages being reported; but the peculiarity is that the cracking is taking place in another direction. They now seem to appear in lines across the tread, parallel to the axle, just the same as they occur on the thermal test; and another peculiarity is that some of these cracks seem to take place in the interior of the wheel and work out, so that it is out of the question for any inspector to tell whether there is an internal flaw in the wheel or not, from outside appearances. Mr. Lobdell has succeeded in developing these internal flaws in a wheel in the thermal test in exactly the same way they appear in these wheels in service, showing it must be due to the braking action. This internal crack is obtained by putting the wheel in the sand as in the ordinary test, but instead of having 1½ in. of material on the outside, simply pouring on about ¼ in. That heats the rim to such an extent that it pulls the material apart on the inside and these little flaws will appear upon the wheel. He informs me he never finds these cracks in a new wheel unless it has been treated in this particular way. The wheel men and the railroad companies whom I visited this year to duplicate my information, or see what improvements have been made, find that they are practically out of the woods. They consider that the cast-iron wheel, as it is now being made, promises to be perfectly suitable and safe for cars of high capacity; but that the wheel which is perfectly satisfactory for a 60,000-lbs. car, and which has done good service under an 80,000-lbs. car, when put under a 100,000-lbs. capacity car, begins to fail and is not exactly the thing that ought to be used; but that the wheels running from 725 to 740 or 750 lbs. made either with the double plate center, or with a single plate thickened somewhat over those under 60,000-lbs. cars, are doing good service and are apparently ready to carry even greater weight than 100,000 lbs.; although one foundry man to whom I put the question, if he would care to build a cast-iron wheel for 120,000-lbs. capacity car, using eight wheels, said he did not think he was ready to do that yet.

One other thing I have found has been done, and that is there is a slight addition made to the amount of charcoal pig used in the mixture. The mixture of a wheel is practically fixed. You must get something which will give you a good chill and you cannot go beyond that, although there has been a slight change made of 5 per cent. additional to the ordinary amount of charcoal pig used in the wheel, which has been found to be very satisfactory. All the manufacturers with whom I have corresponded and railroad men whom I have visited are united in saying that they think the cast-iron wheel has developed to such an extent that there is no hesitation whatever in using it under the high capacity cars.

Mr. McIntosh—There are two features which have contributed largely to the failure of cast-iron wheels. One is the overloading of them, or rather using a wheel of light capacity under a heavy car, and another cause, particularly in the East, is the fact that they have only recently gone into the use of air-brakes, and the fact that up to the present time there was a large number of roads braking their trains over grades by hand, with the result of confining the braking to a few wheels on the train and depending on the brakeman to follow the regulations as to changing their brakes; that is, releasing the brakes that have been on certain cars for a certain time, and putting them on other cars alternately. We all know it is difficult to get trainmen to do this, especially on coal cars, where there is a great deal of trouble in passing from one car to another. It is not done, and the wheel that would render service without failure under a light car on level roads, or even on mountain roads where all the brakes on the train are used, and the work distributed over many wheels, would fail under the system of braking by hand where the brakes are allowed to remain on the same wheels too long.

On motion the wheel manufacturers present at the meeting were invited to give their views.

Mr. Pemberton Smith (N. Y. Car Wheel Works)—As the company I represent was the first to furnish wheels for the 50-ton cars, perhaps I may be pardoned if I am the first one to address you. When the Carnegie Company first decided to build the 50-ton car, it sent to the various wheel makers of the country asking for designs and specifications for a wheel to stand this service. The suggestion seemed to be to increase the weight of the wheel, but to increase it proportionately would increase the thickness of the wheel, which led to serious objections, one from the foundry standpoint being that to increase the thickness of the plates over a certain amount tends to set up shrinkage strains in the wheel; the other objection was quite insuperable, and that is the fact that no matter how much increase was given in the weight of the wheel, there could be no increase given in the thickness through the flange. After the Carnegie Company considered the designs submitted by our company among others, they consulted us further regarding the matter and we recommended a very slight increase, not in the weight, but an increase in the strength of the material, and as we happened to be charcoal iron manufacturers as well as car wheel makers, we knew it was possible, by the selection of ores, to get a higher grade of charcoal iron which would give an increase in strength. There was one ore we had in mind that is a charcoal ore, a bog ore, found in Canada, that seemed to be similar in quality to the Swedish iron. An interesting example of the increase of strength that iron will give, is a comparison of the breaking strain of a 1 in. test bar, 12 in. between supports. All car wheel makers make tests during the period of heating of a material entering the wheel, and the usual size of the bar is 1 in. sq., 12 in. long, and these bars are tested for transverse strength, as tensile strength is not of interest in charcoal iron. In good foundry practice such a bar would break under 2,600 to 3,000 lbs., but by the use of the grade of iron I speak of, we were able to obtain from 3,500 to 3,800 lbs. regularly and have obtained as high as 4,200 lbs., which you will see is a remarkable increase.

The question of the strengthening of the plates really did not come up on the first wheels furnished. The Carnegie Steel Company decided on a wheel of our make, of the special quality indicated, and put them under 1,000 cars in 1897. A large number of the wheels are still in service and not one has been removed for breakage of any kind.

The question of flange breakage came up on the Pennsylvania Railroad owing to their heavy grades and curves. The flange breakages were serious so that we were invited, with others, to recommend a wheel that they would try for this particular service, and the first thing that we did was to start in and make flange tests. We did this with a good deal of interest and found that in the ordinary grade of wheel as furnished for 60,000-lbs. cars, flanges break at different numbers of blows around the circumference of the wheel for no particular reason; but by a combination of material and the method of manufacture, we were able to increase, after a number of experiments, the flange strength about three times, and we then recommended a wheel which they put in and we guarantee against flange breakages. Four hundred of the wheels have been in service and up to the end of the first 12 months, a report from the General Superintendent of Motive Power, which he kindly sent us, shows that about 12, or 3 per cent. of the wheels, had

developed a seam in the throat of the flange and it seems fair to assume that these were the weak and that next year would show even a better service.

There is another feature of the wheel for the 50-ton car which perhaps may tend to decrease the heating action, and that is the grinding of the wheel on the tread, or the machining of it, as we call it. That reduces the likelihood of skidding.

Mr. Barnett—Will a wheel which is made to stand the thermal test according to the M. C. B. specifications, run fully as long as a wheel that is otherwise made, without the standard thermal test?

Mr. Smith—That is an interesting question. The length of time the thermal test has been in operation, I do not think is yet the full life of the wheel, but as far as we are concerned, we have found no difficulty at all in that test.

Mr. Lawes—This is a very valuable report, and I feel that the committees should be continued another year. I make a motion that the committee be continued for another year to investigate the subject further and make another report.

Mr. Waitt—I offer as an amendment that the committee be asked to confer, in connection with the subject, with some of the leading car-wheel manufacturers. I think the information obtained in that way would be very valuable to the Association.

The motion as amended was adopted.

OUTSIDE DIMENSIONS OF BOX CARS.

[*See the Railroad Gazette, June 20, page 472.*]

Mr. Appleyard presented the report and said: In getting the information necessary for making recommendations for the exterior dimensions of box cars, the Committee thought at first that the American Railway Association had specified such a size for interior dimensions as would make it almost impossible to prescribe exterior dimensions for a car, which would enable it to run over all the roads in the country, on account of certain clearance dimensions on certain roads; but after working the information which the Committee obtained, down to a common basis, it was found that the interior dimensions recommended by the American Railway Association would really benefit the Committee and enable them to specify more closely exterior dimensions which would probably lead to the adoption by the Association of a standard car; that is to say, it brought the limits so close that we must virtually come to a standard construction.

Mr. W. E. Fowler—I would ask whether the Committee in recommending the height of 3 ft. 6 in. to the top of the floor, were influenced to any extent by the top-heavy character of this standard car as recommended by the American Railway Association? On a road where the conditions were very severe, in regard to curves and grades, we found difficulty in handling these large cars loaded to the roof with buggies, hay, beer and such commodities. I came to the conclusion that it is better to adopt the low frame car on that account. On the west end of the road I am now connected with, I understand they have a great deal of trouble with cars of that character. Cars loaded to the roof with commodities of any character are under some conditions hard to keep on the rail.

Mr. Appleyard—The committee did not consider the height of the car with reference to its center of gravity or its ability to run around curves or anything of that sort. We were confined to the question of dimensions solely, and if any road chose to build a car with a floor 3 ft. 6 in. above the rail, there could be no objection. The point is that the box of the car must come to these dimensions in order to pass the clearance lines of a majority of the roads.

Mr. Sanderson—I move that the recommendation of the Committee be referred to the Executive Committee, with the view of appointing a committee to report next year on a system of framing for box cars, with inside and outside dimensions as given above the floor of the car, not touching the framing of the car below the floor, leaving that open for steel or combination construction, as preferred. The matter of underframing is not yet far enough advanced to adopt a definite standard in regard to that.

Mr. Quereau—Now is the opportunity for the M. C. B. Association to co-operate with the American Railway Association and the departments represented in that Association. I do not intend to criticize the committee as not having done this, but there are two features in the recommendation of the American Railway Association, one of which has not been acted upon, referring to the outside length of car, and another which our committee has criticized or demurred to; I refer to the size of the side door. I have here a letter worth reading: "I have a proof of a reprint of the report of the M. C. B. Committee on the Outside Dimensions of box cars. There is nothing in this report with reference to the outside length of cars, and to this extent the committee's work is incomplete. The standard inside dimensions adopted by the American Railway Association cover length, width and height, and the resolution requesting the Master Car Builders' Association to consider and adopt the required external dimensions of the standard box car, based upon the interior dimensions as prescribed by the American Railway Association, makes it necessary for the Master Car Builders to establish a standard of external length, as well as of height and width, and in order to make their work complete, the external length should be specified with the same degree of exactness, as they propose to have apply to the height and width."

I believe that the length is as essential to be decided upon as any other part of the car, because of the spacing of doors at freight yards, grain elevators and similar structures. This is as important as the dimensions which the committee has named. Continuing, the writer of the letter says:

"Concerning the size of the side-door opening, which has been fixed at 6 ft. by the American Railway Association, and which the Master Car Builders think is too wide, would say that this question does not admit of any argument. The size of the door opening is determined by the commercial necessities of the service, and it was found by the Committee on Standard Box Cars that 6 ft. was the minimum opening that would serve the purpose. The problem, therefore, of the Master Car Builders is to make the framing strong enough so that a door opening of 6 ft. would not weaken the car. I think there is no doubt that this will be done in a satisfactory manner, as soon as it is realized that the door opening called for cannot be reduced and meet the requirements of the service."

The gentlemen who framed these dimensions, including the door, are in a better position than we to know what the traffic demands. We are experts on the framing of the car, but not on the question of what the dimensions of the opening of the car should be.

I do not think it is possible for this convention, as the matter now stands, to fix on the length of the car, but I believe it would be wise for this convention to state as its opinion, that the external length should be settled upon, and it is possible that it can be done at this convention, so that the work may be completed to that extent. I doubt very much if the American Railway Association would insist upon its adoption at this time if good reasons can be shown why it is not practicable, but I believe we should recognize these two facts: that the width of the door is set at 6 ft. and make our framing accordingly, and that we also recommend a standard outside length.

Mr. Appleyard—In view of the fact that there are in the country now something over one and a half million freight cars, the large proportion of which are box cars of different lengths, it seems to me that there is no especial necessity for determining in this convention what the exterior length of the standard car should be. I believe we should take a little time to study it carefully. It is too important a question to decide about in a convention at this time, and influencing the work of a diligent committee. There are many details in connection with the length of a car which must be worked out to prove satisfactory for all the roads.

A. M. Waitt—When it is considered that it has taken the American Railway Association and the committees of the M. C. B. Association and of several traffic associations in the vicinity of ten years to finally arrive at what are considered satisfactory inside dimensions of cars, I believe that this Association can wisely be conservative in adopting limiting outside dimensions. I think it would be wise to accept the report of the committee as it is, as a report of progress, but not as a finality, and that the committee be continued to take up the subject more fully and completely, obtaining advices from the different roads as to the effect of this last modication of the dimensions of height and width, which change the conditions from what they were in the original proposition which was made, and report more fully, including suggestions for side framing, another year.

Mr. Sanderson's motion that the recommendation of the committee be referred to the Executive Committee, with a view of appointing a committee to report next year, on a system of framing for box cars with inside and outside dimensions, as given above the floor of the car, not touching the framing of the car below the floor, was adopted.

STANDARD PIPE UNIONS.

Mr. George L. Fowler—This report is the same as one which was presented last month to the American Society of Mechanical Engineers in Boston. Their action in regard to it was to refer it back to the committee to consult with the manufacturers in regard to certain details in the manufacture of these unions. The union does not seem to be acceptable to manufacturers. They say that the committee endeavored to make the best possible union they could, but failed to appreciate the commercial considerations in the matter; that it is heavier than is called for under many circumstances and there were some features about the molding of it which would need some modification. The matter was referred back to the committee with instructions to consult with the manufacturers again and see what modifications are necessary to be made so that it would be acceptable as a standard union of the Wrought Iron Pipe Manufacturers' Association.

Mr. Sanderson—In line with what has just been said, I believe it would be unwise to submit these drawings of unions for adoption as standard by letter ballot, without the joint action of the Master Mechanics' Association and the American Society of Mechanical Engineers. I believe that instead of trying to submit this sheet of proposed standard unions to letter ballot, we take some action which would lead to a joint conference and action with the Mechanical Engineers' Society and the Master Mechanics' Association, and then when we do adopt it supply ourselves with the gages and insist on having the fittings made to the gages.

Mr. E. M. Herr—I must correct Mr. Fowler's impression as to the action of the American Society of Mechanical Engineers as to the report of the committee on this subject. As the report was not discussed at that meeting to the extent the committee desired, we virtually took it upon ourselves to continue the work, and we again conferred with the manufacturers and presented the matter to the association the second time. In the discussion before the society the matter of the gasket was discussed. Some of the manufacturers thought it ought to be held in a different way, but I believe a careful consideration will soon show the committee's design to be the correct one, as the discussion brought out the suggestion that the flange be reversed on account of the gasket blowing out. It would be equally bad to have the gasket abraded by the passage of liquids through the gaskets, and the flange on the inside is for that direct purpose. The matter of more direct connection between the external portion of the union and the portion next to the gasket received careful consideration by the committee and it will be found upon a careful analysis of the design, in order to get the proper malleable castings, that the lines as laid out have to be followed.

Mr. Quereau—There is almost an identical report to be presented to the Master Mechanics' Association. It follows the lines of the report of the committee of the American Society of Mechanical Engineers, and recommends that it be adopted by the Master Mechanics' Association. These standards include the Briggs standard for pipe threads and square-headed nuts and bolts, and has been a matter of co-operation between the Master Mechanics' Association, the Master Car Builders' Association and the American Society of Mechanical Engineers, with a full understanding and concentration between all three, so that in all probability the action of the Master Mechanics' Association will be the same as the M. C. B. Association to-day.

Mr. Canfield.—I move that the committee be continued another year and be instructed to confer with the manufacturers of unions.

Carried.

SUBJECTS.

Mr. Brazier presented the report of the Committee on Subjects, which was referred to the Executive Committee.

The report of the Committee on the Recommendations contained in the President's address was presented as follows:

Your committee appointed to consider the suggestions made in the President's address, beg to submit the following as the result of their labor:

First. In reference to the elimination of the parts adopted as standard and not used by members of the Association, your committee would recommend that this be referred to the Committee on Standards, with the suggestion that that committee recommend at the next convention what parts shall be eliminated from the list of standards.

Second. In reference to the admission of private line companies to representative membership on the same basis as railroad companies, your committee would recommend that this privilege be extended the private line companies, with the understanding that no cars bearing railroad initials or lettering will be considered as private line cars.

Your committee would recommend a change in section 3 of article 1 of the constitution, providing for the admission of private companies to representative membership, and would suggest that the Executive Committee take the necessary steps to provide for the required change.

Third. In reference to designs for metal cars and metal underframing, your committee would recommend the appointment of a committee to consider this question thoroughly and to prepare designs for all metal gondola and hopper bottom cars of 80,000 and 100,000 lbs. capacity, and metal underframing for gondola, box and flat cars of the same capacity.

We believe the committee appointed should also be instructed to give careful attention in designing these cars to the accessibility and easy renewal of all parts, and that designs should be shown in both pressed steel and structural steel construction.

Fourth. In reference to cars of larger capacity than 100,000 lbs., your committee is of the opinion that conditions will not warrant the introduction of cars above this capacity, in a general way, and does not feel like recommending or encouraging the construction of cars for general use to exceed 100,000 lbs. carrying capacity.

The report was signed by Messrs. J. E. Simons, A. M. Waitt and F. H. Stark.

Mr. A. M. Waitt—There is one committee, appointed last year, which will make a verbal report, the committee appointed in connection with the revision of the M. C. B. Dictionary. I would say that the members of the Association will undoubtedly receive communications from the *Railroad Gazette*, who are to publish the dictionary, and I earnestly hope on behalf of the committee that the members will cordially co-operate in the revision of this dictionary, which has been of great value. I hope they will send information and blue prints as they may be asked, so as to assist the work which is going on and relieve the committee from more or less anxiety.

Papers on the following topical questions were submitted. We will treat them in future issues:

Foundation Brake Gear; Friction Developed and Strains to Which It is Subjected; by Mr. H. M. Perry.

Modern Requirements and Facilities for Repair Tracks as Influenced by High Capacity Cars; by Mr. L. H. Turner.

Per Diem Charges on Freight Cars, and Their Relation to the Maintenance and Construction of Equipments Under the M. C. B. Rules of Interchange; by Mr. F. W. Brazier.

Is There Any Economy in Fitting Up Yards with Air-Pipes for Testing and Charging Train-Pipes Before Engine is Connected to a Train? by Mr. H. F. Ball.

Progress Made and the Present State of the Art in Improved Methods of Car Lighting; by Mr. L. T. Canfield.

OFFICERS.

On motion the Secretary was authorized to cast the ballot of the Association for the nominees for office presented by the Committee on Nominations, as follows: For President, J. W. Marden; for First Vice-President, F. W. Brazier; for Second Vice-President, W. P. Appleyard; for Third Vice-President, Joseph Buker; for Treasurer, John Kirby; for members of Executive Committee: L. T. Canfield, H. F. Ball, S. F. Prince, Jr.

A vote of thanks was tendered to the retiring President, Mr. J. J. Hennessey, for his uniformly courteous treatment of all the members of this Association, as its presiding officer. The meeting then adjourned.

New Shops of the Oregon Short Line Railroad.

The Oregon Short Line is building entire new shops at Pocatello, Idaho. Being at the junction of the Idaho and Montana Divisions, Pocatello is the most convenient and central point for the location of shops to maintain the equipment on these two divisions. The completed plant will include a machine shop, blacksmith shop, boiler shop and wheel and truck shop, all under one roof; a car shop, foundry, power station, transfer table and an addition to the present roundhouse. All buildings are to be of brick with stone trimmings and steel roof frames. Ample provision for light has been made in roofs and walls.

The power station is 75 ft. by 90 ft., built of brick, and has a Custodis brick stack 7 ft. inside diameter and 150 ft. high. Steam will be supplied by five horizontal tubular boilers at 125 lbs. pressure. The shells of the boilers are to be 72 in. in diameter and they will have double fire and arch doors. There will be two Westinghouse simple non-condensing engines, each direct-connected to a 150-k.w., 250-volt, compound-wound multipolar generator. The engines are rated at 275 i.h.p. at 100 lbs. initial pressure, and running at 250 r.p.m. There will also be a smaller Westinghouse simple non-condensing engine, 75 i.h.p. at 320 r.p.m., direct-connected to a 50-k.w., 250 volt, direct-current, compound-wound generator. Westinghouse electric equipment will be used throughout the plant. Compressed air will be furnished by an Ingersoll-Sergeant duplex, style "G" machine, having the air cylinders compounded. The capacity will be 1,000 cu. ft. of free air per minute. The station will be provided with a 15-ton hand crane.

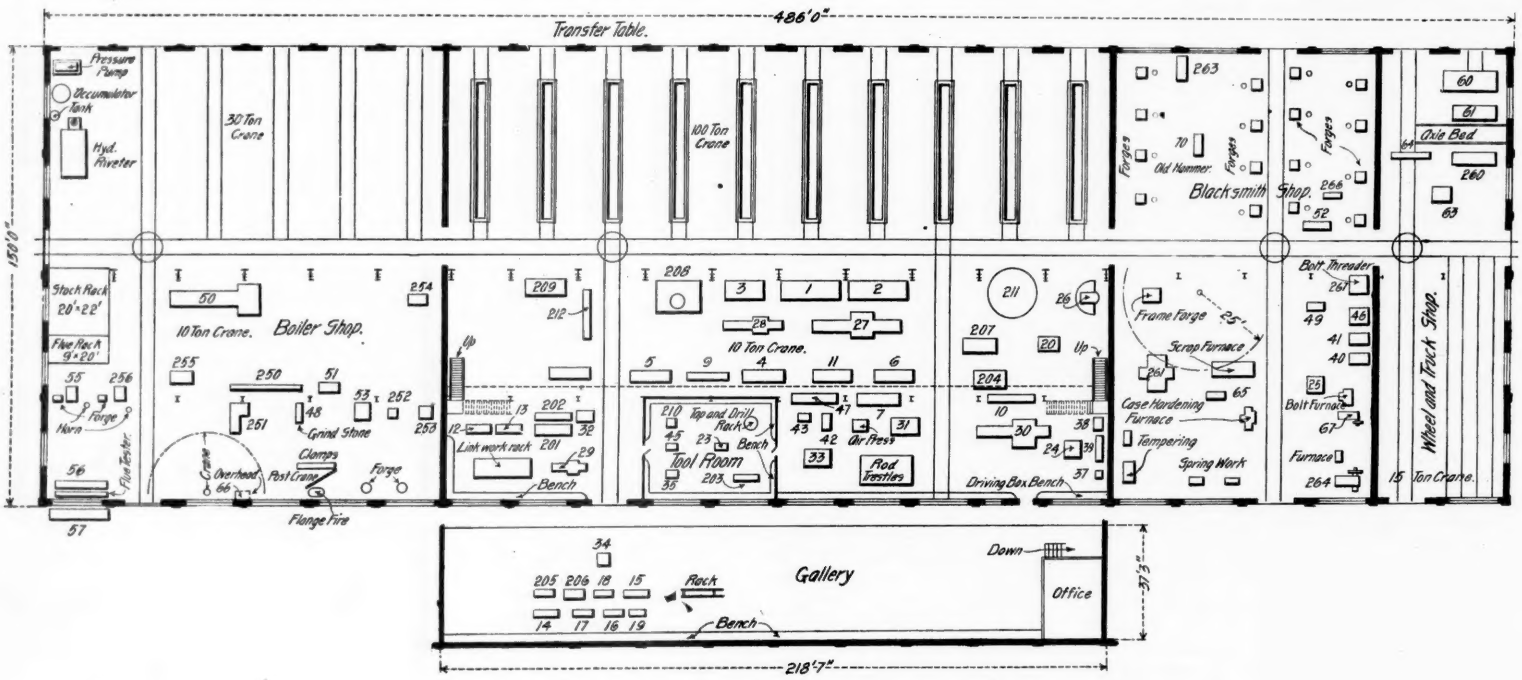
The main building, of which we show a plan, is 486 ft. long by 150 ft. wide, and is divided into four compartments for the several shops mentioned, as follows: Machine shop, 146 ft. 6 in. by 218 ft. 7 in.; blacksmith shop, 86 ft. 7 in. by 146 ft. 6 in.; boiler shop, 130 ft. 6½ in. by 146 ft. 6 in.; wheel and truck shop, 42 ft. 6 in. by 146 ft. 6 in. The machine shop will have a gallery 37 ft. 3 in. wide and running the length of the shop. There will be 10 pits for locomotives.

The plan of the main building shows the proposed tool arrangement. Following is a list of the tools with the names of the makers:

No. 1—Wheel lathe, 76 in. .... Niles
No. 2—Wheel lathe, 78 in. .... Putnam
No. 3—Lathe, 54 in. x 8 ft. .... Putnam
No. 4—Lathe, 26 in. x 8 ft. .... Pond
No. 5—Lathe, 30 in. x 10 ft. .... Putnam
No. 6—Lathe, 24 in. x 8 ft. .... Fitchburg
No. 7—Lathe, 20 in. x 9 ft. .... Putnam
No. 8—Lathe, 36 in. x 6 ft. .... Pond
No. 9—Lathe, 28 in. x 10 ft. .... Putnam
No. 10—Lathe, 20 in. x 12 ft. .... Sellers
No. 11—Lathe .... Jones & Lamson
No. 12—Lathe, 18 in. x 5 ft. .... Putnam
No. 13—Lathe, 18 in. x 5 ft. .... Putnam
No. 14—Lathe, 18 in. x 5 ft. .... Putnam
No. 15—Lathe, 15 in. x 4 ft. 6 in. .... Fitchburg
No. 16—Lathe, 16 in. x 3 ft. .... Flather
No. 17—Lathe, 16 in. x 3 ft. .... Flather
No. 18—Lathe Fox .... Kirkwood
No. 19—Lathe, 16 in. x 3 ft. .... Fifield
No. 20—Boring mill, 36 in. .... Niles
No. 23—Drill press, 16-in.
No. 24—Drill press, 30-in. .... Pond
No. 25—Drill press, 30-in. .... Pond
No. 26—Radial drill No. 3 .... Pond
No. 27—Planer, 38 in. x 16 ft. .... Niles
No. 28—Planer, 36 in. x 10 ft. .... Niles
No. 29—Planer, 24 in. x 6 ft. .... Fitchburg
No. 30—Planer, 38 in. x 12 ft. .... Pond
No. 31—Slotter, 20-in. .... Niles
No. 32—Slotter, 13-in. .... Bement
No. 33—Shaper, 20-in. .... Niles
No. 34—Shaper, small.
No. 35—No. 1 Milling machine .... Brainard
No. 37—Nut facer.
No. 38—Nut tapper, 6 taps (iron) .... Niles
No. 39—Nut tapper, 7 taps (round) .... Durrell
No. 40—Bolt cutter, single .... Acme
No. 41—Bolt cutter, single .... Putnam
No. 42—Grind stone.
No. 43—Emery wheel.
No. 45—Universal grinder .... Brainard
No. 46—Bolt cutter, single.
No. 47—Lathe, 27 in. x 14 ft. .... Pond
No. 48—Grind stone.
No. 49—Grind stone.
No. 50—Bending rolls, 12 ft. 0 in. .... Hilles & Jones
No. 51—Bending rolls, 6 ft. hand.
No. 52—Combined punch and shears .... Long & Allstatter
No. 53—Universal radial drill .... U. R. D. Co.
No. 55—Flue welder .... Hartz
No. 56—Flue cutter.
No. 57—Flue rattler.
No. 60—Car wheel tire lathe.
No. 61—D. H. axle lathe .... Niles
No. 63—Wheel mill .... Niles
No. 64—Car wheel press .... Niles
No. 65—No. 8 fan blower.
No. 66—No. 5 fan blower.
No. 67—Bolt header .... Rome
No. 70—Steam hammer .... Morgan
No. 201—Lathe, 24 in. x 12 ft. .... Niles
No. 202—Lathe, 22 in. x 12 ft. .... Niles
No. 203—Lathe, 18 in. x 8 ft. .... Niles
No. 204—No. 3 Horizontal boring mill .... Niles
No. 205—Turret lathe, 22 in. .... Bullard
No. 206—Turret lathe, 18 in., No. 2 .... Niles
No. 207—Slotter, 24 ft. .... Niles
No. 208—Boring mill, 6 ft. .... Niles
No. 209—Lathe, 42 in. x 16 ft. .... Pond
No. 210—Yankee twist drill grinder.
No. 211—Universal radial drill .... Niles
No. 212—Wheel press, 90 in. .... Niles
No. 250—Plate planer, 20 ft. .... Niles
No. 251—Flange punch .... Long & Allstatter
No. 252—Suspension drill.
No. 253—Staybolt threader .... Acme
No. 254—Splitting shear .... Long & Allstatter
No. 255—Punch and shear .... Long & Allstatter
No. 256—Flue welder .... Hartz & Fix
No. 260—D. H. axle lathe, No. 6 .... Niles
No. 261—Steam hammer, 4,000 lbs. .... Bement & Miles
No. 263—Fan blower, No. 9.
No. 264—No. 6 bulldozer .... Williams & White
No. 266—Helve hammer, 80 lbs. .... Bradley
No. 267—D. H. bolt threader .... Niles

All tools will be electrically driven, the larger ones by independent motors; the smaller ones will be grouped and belted to line shafting, driven by larger motors. Over the machine shop pits there will be a 100-ton crane, having a span of 69 ft. 9½ in. The travel will be 220 ft. and there will be two hoists of 50 tons capacity each. A 10-ton crane will serve the tools in the machine shop. It will have a span of 38 ft. 8 in., one hoist of 10 tons capacity, and travel 220 ft. The boiler shop will have a 30-ton crane over the pits. Its span will be 38 ft. 8 in., travel 130 ft., and there will be two hoists of 15 tons capacity each. A 10-ton crane having a span of 38 ft. 8 in., a single hoist, and a 130-ft. travel, will be placed over the tools. The truck shop is to have a 15-ton crane of 41 ft. 6½ in. span, 75 ft. travel, and two 7½-ton hoists.

The car shop and foundry will not be built until later on. The car shop will stand opposite the machine shop and a transfer table will operate between. This table will be 80 ft. long and have a capacity of 200 tons; it will be electrically driven. The pit will be 80 ft. by 520 ft. In addition to the shop buildings the present roundhouse of 20 stalls is to be enlarged to 30 stalls. It is expected to heat the buildings by the Sturtevant system.



The Main Building of the Pocatello Shops of the Oregon Short Line.

TECHNICAL.

Manufacturing and Business.

W. C. Allison has resigned as General Manager of the Niles Car & Mfg. Co., Niles, Ohio.

The Pittsburgh Blue Print Co. has secured Senor Ernesto Thomas, of Santiago, Chile, to represent it in the countries of Peru, Ecuador, Colombia, Bolivia and Chile.

The Railway Supply Co. is reported incorporated in New Jersey, with $1,200,000 capital, to make railroad supplies. Those interested are Wm. J. Field, J. Richard Tennant and R. F. Tully.

James Rowland Bibbins has resigned as Assistant Electrical Engineer of the Detroit United Railway to accept a position in the Westinghouse Companies' Publishing Department, Pittsburgh and New York.

The American Machinery Co., of Willoughby, Ohio, has just shipped two additional bolt-heading machines to the Detroit plant of the American Car & Foundry Co.; also a 2½-in. American bolt header to the Pencoyd Works of the American Bridge Co. The company is now making grab-iron machines, the entire grab-iron being made in one operation by this new device.

The General Construction Company was organized in Iowa, June 18, with a capital stock of $100,000, to engage in building bridges, buildings, masonry, highways, streets and pavements, sewerage systems, water works, etc. The officers are: George H. Boynton, president, of Chicago, Ill.; Frank Sherman, vice-president, of Chicago, and Amos Cutter, secretary and treasurer, of Davenport, Iowa. The office is at Davenport.

The Riter-Conley Mfg. Co., of Pittsburgh, Pa., has recently decided to adopt alternating current motors exclusively for power distribution and has bought three 200 k.-w. engine-type Westinghouse generators, which are to be direct-connected to Westinghouse gas engines using natural gas. Alternating currents will be used for all work, including cranes, and a number of Westinghouse type "F" induction motors will be geared directly to straightening rolls.

At a meeting of the directors of the Chicago Pneumatic Tool Co., New York City, last week, two new members were added to the Executive Committee, which is now composed of Chas. M. Schwab, C. H. Matthiessen, J. R. McGinley, J. W. Duntley and Max Pam. E. M. Hurley resigned as a director and W. J. Calhoun succeeds him. The directors decided to exercise the option which the company owns upon a British plant, which is to be bought in by an issue of $200,000 of treasury stock.

Last week (page 483) we told of the incorporation of the Gold Car Heating & Lighting Co., with a capital of $1,000,000, which has bought the business of the Gold Car Heating Co. and of the Gold Street Car Heating Co. The company is now equipping new cars or locomotives for the following railroads: New York Central & Hudson River, Lake Shore & Michigan Southern, Central of New Jersey, Delaware, Lackawanna & Western; Lehigh Valley, Norfolk & Western, Philadelphia & Reading, New York, Ontario & Western; Chesapeake & Ohio, Southern, Atlantic Coast Line, Plant System, Alabama Great Southern, Waycross Air Line, Cincinnati Southern, Nashville, Chattanooga & St. Louis; Louisville &

Nashville, Northern Pacific, Minneapolis, St. Paul & Sault Ste. Marie; Chicago, Burlington & Quincy; Missouri Pacific, Texas & Pacific, Denver & Rio Grande, Union Pacific, New Orleans & North Eastern, and Pittsburgh & Lake Erie.

The Continental Iron Works, of Brooklyn, N. Y., has recently bought from the Westinghouse Electric & Manufacturing Co. considerable additions to their electrical equipment. The purchase includes a 180 k.-w., 220 volt, 60 cycle, two-phase alternator; a five-panel switchboard, 11 induction motors of from 5 to 20 h.-p. each, with the accompanying auto-starters. The company some time ago installed alternators of 120 k.-w. and 45 k.-w. each, and of the same characteristics as the above. They also have quite a number of induction motors in use driving corrugating and bending rolls for making Morrison fire-boxes; also driving fans, shears, tools in the machine shop, etc. Some of the motors which have recently been purchased are to displace direct-current motors. When the new 180 k.-w. alternator is installed the old direct-current generator will be used as an exciter, also furnishing current to one or two small direct-current motors which will be used for a while until they are worn out.

Iron and Steel.

The International Steel & Machinery Co., of New York, has been organized with $25,000 capital by D. L. Robertson, of Glens Falls; H. K. Bock and W. D. Farrington, of Brooklyn.

Plans have been made by the Riter-Conley Mfg. Co., Pittsburgh, to establish at its Leetsdale Works a plant to build sea-going barges and tank steamers. The company already has contracts for several of the latter kind of boats.

Wm. G. Fitzgerald, formerly Superintendent of the Baltimore Ship Building & Dry Dock Co., has leased the Atlantic Iron Works adjoining the shipyard and has started in with a number of contracts for marine and stationary engines.

The Wichita Bridge & Iron Co., of Wichita, Kan., is a consolidation of the Wichita Bridge Co., Wichita Mfg. Co. and the Globe Iron Works. G. H. Bradford is President; Henry Anthony, Vice-President; E. D. Miles, Secretary and Engineer.

The directors of the Pennsylvania Steel Co. have decided to issue $7,500,000 more bonds and to secure the consent of the stockholders a special meeting will be held on Aug. 12. The proceeds will be used to buy the extensive ore mines and furnaces at Cornwall, Lebanon County, Pa.

The Bethlehem Steel Co. has a contract to make the cast-iron segments that will be used in lining the tunnel to be built under the Hudson River at New York for the Pennsylvania R. R. To fill the order, part of the old Bessemer plant of the company will be converted into an iron foundry.

Baldwin Locomotive No. 20,000.

The reader will remember Baldwin locomotive No. 20,000, which was built last winter. It is a four-cylinder compound engine, two of the cylinders being inside the frame and all lying in one horizontal plane. This engine was described in the *Railroad Gazette* at the time of its completion. It has been known for some time that the engine was found too heavy for the bridges of the Plant System, for which road it was built, and, therefore, it could not be accepted by that company. So far as we have been able to learn, this did not come about through any negligence on the part of the builders. However, there has been no difference of opinion between them and the railroad company in the matter, the Baldwins having simply kept the engine for another customer. On the 18th of this month it was sold, but we do not know the name of the buyer. It will probably be 20 days yet before the engine is ready for shipment, because the Vanderbilt tender originally built for it has been sold and another tender must be built. The new tender will be of the ordinary pattern.

Tunnel Ventilation.

In the six-mile-long Giovi Tunnel, north of Genoa, a block station has been established, so that two trains in the same direction may be in the tunnel at the same time. This is proof of the effectiveness of the ventilation recently introduced. It is in this tunnel that trainmen were asphyxiated and before the Saccardo ventilating apparatus was introduced it would have been impossible to see the signal lights more than a few feet, by reason of the dense smoke. Recently 12 double-headed freight trains have passed through the tunnel within three hours, and yet the signals were perfectly distinguishable.

The Simplon Tunnel.

The progress of the Simplon Tunnel in April was 454 ft. at the north end and only 46 ft. at the south end. The total penetration at the end of the month was 37,556 ft., or more than 7 miles, nearly five-eighths of which was at the north end. The number of men employed was 3,167, of whom 2,230 worked inside. On the northern end during the month water-bearing horizontal strata of slate were passed, extending only 23 ft., one of the springs in which had a temperature of 122 degrees. On the south end, where the great outgush of water has prevented machine drilling for some months, the discharge of water has diminished, but still amounts to 20,500,000 gals. daily. Notwithstanding the great delay caused by this water it is still thought possible to complete the tunnel in the time specified by the contract. This will require a daily penetration of 39 ft. On the north end there has been a sudden and unexpectedly great increase of the heat. At kilometer 7 the estimates had calculated the probable heat as 97½ deg.; it was actually, March 15, 119 deg., and that 654 ft. before reaching kilometer 7, and the ventilation 12 days later had reduced it only to 101½ degrees. This unusual heat is ascribed to the extraordinary dryness of the rock. On the south side the channel for carrying off the water is to be made an entire meter wide.

Rosendale Cement Companies Consolidate.

The Consolidated Rosendale Cement Co., which was incorporated under the laws of New York in January last, has acquired the following companies, which embrace all, except one, of the leading Ulster County cement properties: F. O. Norton Cement Co., Lawrenceville Cement Co., Newark & Rosendale Lime & Cement Co., New York & Rosendale Cement Co. and the Hiram Snyder Co. The capital stock is $1,500,000 and the company has made a guarantee to the Continental Trust Co., of New York city, to secure $1,100,000 5 per cent. 20-year gold bonds. William N. Beach is president and Joseph P. Paulding secretary. The other directors are A. Lanfear Norrie, Albert C. Hall, William L. Lyman, Philip M. Brett, Stephen M. Plum, F. A. Doremus and Edgar Knapp. Over 3,500,000 barrels of Rosendale cement will be made yearly.

Two New 600-Ton Blast Furnaces.

The Riter-Conley Manufacturing Co., Pittsburgh, has been awarded the contracts for the erection of Carrie blast furnace No. 5 for the Carnegie Company and a furnace for the Detroit Iron & Steel Co. Each furnace will cost about $1,000,000 and it is expected they will be completed within nine months or one year. The new Carrie furnace will be 90 ft. high, 20 ft. in diameter at the bosh and will have a capacity for 600 tons. The contract includes an extension to the iron ore bins and handling equipment and involves about 1,500 tons of steel. The furnaces at Rankin, just completed, are 100 ft. high and 22 ft. in diameter at the bosh, and can produce over 800 tons a day, although the rated capacity is not over 600 tons.

The Detroit furnace, to be erected on Brady's Island, that city, will be 90 ft. high and 21 ft. at the bosh, with a capacity of between 500 and 600 tons a day. It will be completed within the next eight or ten months.

The Engineering of the Detroit Works of the American Car & Foundry Co.

In our issue of June 13 appeared a description, with a number of illustrations, of the Steel Car Works of the American Car & Foundry Co., at Detroit. In the course of that description we said that "the power installation was made by Westinghouse, Church, Kerr & Co." We are informed by the Westinghouse Companies' Publishing Department that Westinghouse, Church, Kerr & Co. "were engineers for the entire work and any credit due for the manner in which the engineering was carried out belongs to them."

Steel Car Patent Suit.

Judge Buffington, in the United States Circuit Court, at Pittsburgh, in the case of the Pressed Steel Car Company vs. John M. Hansen, has decided that Mr. Hansen may make assignment of the patents and applications in dispute, subject to the final decision of the court. The order also provides that the applications for patents shall be placed in the hands of an attorney for each side pending the final granting of the patents. Mr. Hansen says that the decision will have no effect upon the business of the Standard Steel Car Company. The cars which the company is building and has contracted to build are made from entirely new designs using structural shapes in no way involving any of the patents in question.

Pintsch Gas Lighting.

In telling of the growth of the Pintsch Light in last week's issue, page 483, the number of cars equipped in the past five years in all countries was given as 8,800. This was wrong; that number represents the 5-year increase in a single country. The number of equipments supplied to the railroads of the world since 1897 is 28,600, 8,800 of which were ordered by the railroads of Germany and 8,300 by those of this country.

THE SCRAP HEAP.

Notes.

The Chicago Great Western has advanced the wages of a considerable number of its telegraph operators.

The Chicago, Rock Island & Pacific has lately abandoned the use of speed recorders in the cabooses of freight trains.

The payment of pensions on the Metropolitan Street Railway of New York, as heretofore announced, will begin July 1.

A Peoria paper says that the Illinois Central is going to adopt green for the all-clear color for signals, in place of white. Yellow will be adopted for caution.

At Conway, 22 miles from Pittsburgh, on the Fort Wayne line, the Pennsylvania Company has put up a building costing $30,000 for the social uses of the trainmen.

Philadelphia newspapers appear to be satisfied that the Pennsylvania Railroad has concluded a contract with the Postal Telegraph Co. which will result in the discontinuance of Western Union offices at all stations on that road on Jan. 1 next.

Atlantic Standard Time, the time of the 60th meridian, one hour faster than Eastern time, was adopted on June 15 by the railroads of New Brunswick, Nova Scotia, Cape Breton and Prince Edward Island. Heretofore these roads have used Eastern standard time.

Chicago papers announce that beginning July 6 the Burlington road will run its express train No. 1 from Chicago to Denver, 1,022 miles, in 26 hrs. 20 min., leaving Chicago at 5 p. m. This is about the same time as that of the fast train recently started by the Chicago & North Western.

The Appellate Division of the Supreme Court of New York has affirmed a verdict, found by a jury in Westchester County, for $60,000 damages for the death of Henry G. Dimond, a man who was killed in the rear collision of passenger trains in the Fourth Avenue tunnel in New York city, Jan. 8.

On June 17, the anniversary of the Battle of Bunker Hill, the elevated railroad of Boston carried 300,000 passengers. The business was practically all done with four-car trains, and the car mileage was 24,902. On the surface and elevated lines together the Boston Elevated Railway Co. carried 1,311,000 passengers.

A press despatch from Altoona, June 24, says that the fast mail train of the Pennsylvania from New York to St. Louis (1,058 miles) is now traversing that distance in 20 hours; or at the rate of 52.9 miles an hour. On June 21 this train was run from Harrisburg to Altoona (132 miles) in 2 hrs. 9 min. The train usually has only three cars.

The railroads centering in Buffalo have agreed that on cars switched by one road for another an allowance of four days shall be made in favor of the switching road. At Cleveland a similar rule has been adopted, with a provision also for an allowance of one day for cars in transit; meaning, we suppose, cars which are switched by an intermediate road.

Traffic Notes.

According to a press despatch, the Great Northern Railway carries 50 farmers from each village on its line in North Dakota to Fargo, free of charge, to attend institutes held by the faculty of the State Agricultural College.

The Railroad Commissioners of Texas have issued an order to the effect that all of the railroads in the state which are controlled by or in the interest of the Southern Pacific must, in the application of freight tariffs, be treated as one company. This means a radical reduction in rates for the transportation of freight where two or more of these subordinate railroad companies participate in the rate.

The hearing on the temporary injunction under which numerous railroads are restrained from cutting rates, which was to have been held at Chicago, June 23, has been postponed. It is said that the cases will be taken up "some time next fall," and some of the reporters think that the railroads, although they had prepared technical objections, are satisfied to allow the temporary injunction to remain in force, indefinitely.

The Pennsylvania and the Baltimore & Ohio have made a reduction in the rate on grain from Fairport, Ohio, to Baltimore. This reduction has been followed by a reduction on grain from Buffalo to New York of about half a cent. The new rates are: On wheat, 3.9 cents a bushel; on corn, 3.7 cents a bushel, and on oats, 3.2 cents a bushel. The Baltimore rate is now only four mills lower than the rate to New York. The new tariff to New York is announced as to be kept in effect until July 15.

At Atlanta, June 20, the Federal Grand Jury returned indictments against five railroads, and individuals representing the railroads, charging them with violating the Interstate Commerce law and the Sherman anti-trust law. The railroads indicted are the Southern, Seaboard Air Line, Atlanta & West Point, Western & Atlantic and the Georgia. The individuals are W. W. Finley and F. A. Neal, of the Southern; Charles A. Wickersham and R. E. Lutz, of the Atlanta & West Point; H. F. Smith and J. A. Sams, of the Western & Atlantic; R. I. Cheatham, of the Seaboard Air Line; S. E. Magill and E. O. Pritchard, of the Georgia, and S. F. Parrott, chairman of the Southeastern Freight Association.

Railroads in Guatemala.

James C. McNally, Consul General at Guatemala City, writes under date of May 9 that the work of building the Northern R. R. from El Rancho to Guatemala City is progressing very encouragingly. Grading has been completed to Sanarate, about 50 miles from Guatemala City, and from that point work is to be pushed as rapidly as possible. It is expected that within six months trains will be running between Sanarate and Puerto Barrios. Between Sanarate and Guatemala City a stage line for the present will be used. Completion of the Northern R. R. will be of great benefit to Guatemala, as it will considerably shorten the time to New Orleans. Only about six days will then be required to reach the United States from Guatemala City, whereas the trip on the Pacific side takes from seven to 12 days longer. Freight transportation will also be cheaper than by the Pacific route.

30-Ton and 40-Ton Cars in England.

The Midland Railway of England has ordered from the Leeds Forge Co. 30 steel coal cars to carry 30 tons each. The cars weigh about 10½ tons each and have vacuum brakes. The same shop has an order for 50 40-ton cars for the North Eastern Railway. All these cars have trucks and underframes made of pressed steel plates.

Launch of the "Denver."

The U. S. protected cruised "Denver" was launched on June 21 from the yards of Neafie & Levy at Philadelphia. The "Denver" is built of steel and wood and is of 3,100 tons displacement, with twin screws and 4,700 i. h. p.

Passenger Fares in Japan.

In 1899 the passenger fares on the Japanese State Railroads were raised. There was at first some decrease in travel, but the passenger earnings were materially increased. Now a further increase, on the average about 20 per cent., is made in fares for distances of 100 miles or less, and in addition an extra charge is made on the two express trains between Tokio and Kobe. This

charge is independent of the distance traveled and is imposed purposely to keep local travel off the express trains. Heretofore this object was attempted by refusing to sell tickets for less than 40 miles on the day express and for less than 60 miles on the night express.

Getting Hurt as a Speculation.

In a collision in Austria a person was so scalded by hot water from the locomotive that he suffered greatly and did not recover for several months. He brought suit and claimed $20,000 damages. The railroad did not deny its responsibility, but urged that the amount demanded was absurdly excessive. The court awarded the complainant $2,400, with the remark that a railroad accident must not be considered to be a grand prize in a lottery.

An accident near Heidelberg, some time ago, injured an exceptionally large number of persons. The government of Baden has been paying the claims for damages, which, according to a statement of a minister in Parliament, have amounted to $329,000. One victim got $33,082, another $22,848, and several $19,040. This is likely to make accidents popular—with passengers.

Hungarian State Railroads.

The Hungarian Minister of Commerce, who has charge of the State Railroads, recently died, and in his place has been appointed a Dr. Langh, author of several works on financial and economical questions and Professor of Statistics in the Budapest University since 1891. For two years previously he had been Assistant Secretary in the Ministry of Finance. The new minister has long been a prominent member of Parliament and is credited with decided opinions on railroad policy and especially with the conviction that the State Railroads ought to be made to yield larger profits. After a time, it is said, the State Railroads are to be separated from the Ministry of Commerce and a ministry established especially to take charge of them.

The Suez Canal—Reduction of Tonnage Dues.

The Suez Canal Company are about to take a further step in the execution of the arrangement concluded with the Association of British Steamship Owners in 1883, known as the London Programme, by which the tonnage dues on vessels passing through the canal would be gradually reduced as the receipts and profits of the company increased. The charge was then 10 francs per net ton. A first reduction to 9f. 50c. was made in 1885; a second to 9f. in 1893. The report that will be read at the annual meeting of shareholders, to be held on Tuesday next, will contain a proposal to go further, and reduce the rate to 8f. 50c. per ton from January 1 next. Strictly, the assent of the body of shareholders was not necessary, as the board of directors is empowered by the company's concession and statutes to modify the tolls if advisable. The board, however, in a matter of this importance, have preferred to give shareholders an opportunity of expressing an opinion by adopting or rejecting the report in which the reduction is announced. They are confident that with the continued development of the traffic the receipts and dividend in 1903, with a rate of 8f. 50c. per ton, will show no diminution on those of 1901 with the charge of 9f. The results of the first five months of the present year show already, compared with 1901, an increase of receipts from £1,689,766 to £1,852,252. The balance sheet for 1901 that will be submitted to the meeting will show that the gross receipts for that year amounted to £4,124,869, which was an increase of £386,813 on 1900; while the expenses, amounting to £1,029,839, rose only £3,909 on the year. Adding to the expenses a sum of £472,026 for amortization, and £75,450 carried to the reserve, a net balance of £2,435,001 remains for distribution among the three classes of shareholders—ordinary shares, unredeemed and redeemed, and founders' shares—which will receive, including interim payments made, net dividends respectively of 125f., 101f. 65c., and 57f. 77c.—*The Economist (London).*

LOCOMOTIVE BUILDING.

The Standard Oil Co. is having a locomotive built at the Baldwin Works.

The Mt. Jewett, Kinzua & Riterville is having a locomotive built at the Baldwin Works.

The Kansas City Belt Line is having two locomotives built at the Baldwin Works, in addition to the order reported in our issue of March 7.

CAR BUILDING.

The Southern is having 700 freight cars built at the Georgia Car & Mfg. Co.

The Atchison, Topeka & Santa Fe is having 27 coaches built at the Pullman Works.

The Mather Stock Car Co. is having 195 freights built at the South Baltimore Car Works.

The Southern is reported in the market for 60 miscellaneous passenger, baggage and express cars.

The Illinois Zinc Co. is having 25 freights built at the Milton Works of the American Car & Foundry Co.

The St. Louis & Gulf has ordered 20 flat cars additional from F. M. Hicks, to be rebuilt by the Hicks Locomotive & Car Works.

The Colorado & Southern has ordered from F. M. Hicks one combination car and four coaches, to be rebuilt by the Hicks Locomotive & Car Works.

The Chicago, Burlington & Quincy has asked one or two builders for approximate prices on 800 coal cars. Whether the order will be placed has not been decided.

The Costa Rica Ry. has ordered seven freights from the Hungarian Railway, Wagon & Machine Works in Austria. They will be equipped with Westinghouse air-brakes.

The El Paso & Southwestern order for 50 freights, reported in our issue of June 20, calls for box cars of 80,000 lbs., to be built by Haskell & Barker for July delivery. Length, 40 ft.; width, 9 ft. 1⅝ in. over side sills; to be built of wood with wood underframes.

The Cincinnati, New Orleans & Texas Pacific sends further particulars in regard to their recent orders, reported in our issue of June 20, which specify 200 box cars, 300 hopper bottom coal cars, 125 drop bottom coal cars, 150 ore dump and 50 coke cars, making a total, as stated, of 825. All of these cars will be of 60,000 lbs. capacity and are for October and November delivery.

The Baltimore & Ohio order for three dining and two cafe parlor cars, reported in our issue of May 30, will be built by the Pullman Co., for October delivery. Length, 70 ft. and width 9 ft. 8 in. over frame. The special equipment includes 4½ x 8⅛ in. collarless axles, National hollow brake-beams, cast-iron brake-shoes, Westinghouse air-brakes, B. & O. brasses, Buhoup three-stem couplers, Forsythe curtain fixtures, Pantasote silk-lined curtains, Safety heating system, cast-iron journal boxes, pressed steel journal box lids, B. & O. standard paint, standard steel platforms, Pullman 5-A trucks and wide vestibules. To be lighted by electricity and Pintsch gas.

The Cane Belt has ordered 30 box cars and one combination baggage, mail and express car from the American Car & Foundry Co. The box cars will be of 60,000 lbs. capacity; 36 ft. long over end sills, 9 ft. wide over side sills and 6 ft. 9 in. high from sill to plate. The special equipment includes Carnegie steel axles, Common Sense body and truck bolsters, Diamond inside hung brake-beams, Westinghouse air-brakes, M. C. B. brasses, Trojan couplers, National Malleable door fastenings, Q. & C. trolley side door fixtures, M. C. B. draft rigging, Winslow roofs, Diamond arch bar type trucks and American Car & Foundry Co.'s wheels. The combination baggage, mail and express car will be 50 ft. long, 9 ft. 8 in. wide and 10 ft. 3¼ in. high. The special equipment includes Westinghouse air-brakes, Janney Buhoup couplers, Baker heating system and Janney Buhoup platforms.

BRIDGE BUILDING.

Akron, Ohio.—The contract for building the Falor street bridge will probably be let in a few days.

Bethel, Mo.—The Shelby County Court has ordered a steel bridge across Salt River at Bethel; also a bridge across Black Creek east of Leonard.

Boston, Mass.—The City Engineer has recently submitted a report to the Mayor in regard to building new bridges on Geneva avenue, Harvard street, West Selden street and Norfolk street in Dorchester. The report is now with the Board of Aldermen.

Bridgeport, Jackson County, W. Va.—It is said that a steel bridge to cost about $15,000 will be built across Wheeling Creek. The city will pay $12,000 and the county $3,000.

Butler, Mo.—Bids are wanted until July 8, 1 p.m., for building five steel bridges of various sizes. R. E. Johnson, Road and Bridge Commissioner.

Camden, N. J.—The Board of Freeholders will probably soon be ready to get bids for building the bridge over Cooper's Creek at Pine street, which is estimated to cost $25,000.

Cincinnati, Ohio.—Bids are wanted July 12 for building the substructure of a bridge over Duck Creek in Fairview avenue, Columbia Township. Eugene L. Lewis, County Auditor.

Cuyahoga Falls, Ohio.—It is said the Northern Ohio Traction Co. has decided to build a high-level bridge, costing $50,000, over the gorge at Cuyahoga Falls, and the contract will be let soon.

Damascus, Va.—Bids are wanted July 8 for a steel highway bridge. Address R. B. Preston at Lodi, Va.

Dayton, Ohio.—Bids for the steel bridge over the Great Miami at North Main street are wanted July 12. Address Board of City Affairs.

Detroit, Mich.—The Detroit & Buffalo Steamboat Co. is reported having plans made for a viaduct at its boat-landing.

Doylestown, Pa.—It is said that the State Superintendent of Grounds and Buildings will probably want bids soon for the bridge over the Schuylkill at Cross Keyes, near Doylestown, which is to cost about $8,500.

Duluth, Minn.—Bids, with plans and specifications, are wanted by the Board of County Commissioners until July 8, for a steel bridge of 180-ft. span across Cloquet River in St. Louis County. O. Halden, County Auditor.

Erie, Kan.—Bids are wanted July 12 by the Board of County Commissioners for three steel bridges, the main spans of which are of the following lengths: 65 ft., 125 ft., 150 ft. H. Lodge, Chairman.

Fredericton, N. B.—C. Labillois, Commissioner of Public Works, will shortly call for tenders for rebuilding several bridges. One at Newcastle and one at Cole's Island, Kings County, will be permanent steel structures.

Greenwood, Miss.—Bids are wanted, with plans and specifications, for a bridge over Pelucia Bayou.

Gulfport, Miss.—The Gulf & Ship Island Ry. contemplates building new bridges in place of wooden structures, and renewing trestles and a lot of other work.

Hamilton, Mont.—Bids are wanted July 7 for a combination bridge 150 ft. long, with 112 ft. of approaches. Address Howard B. Smart, County Clerk.

Helena, Mont.—Bids are wanted July 19 by the County Clerk of Lewis and Clarke Counties for building a steel or combination bridge over the Missouri at the town of Craig. Sidney Miller, County Clerk.

Independence, Mo.—Regarding the report that the Metropolitan Street Ry. of Kansas City will build a new steel bridge over Blue River, we are told that bids will not be wanted on this work at the present time.

Indianapolis, Ind.—The County Commissioners want bids until July 1 for a plate girder bridge over Lick Creek, Perry Township; a plate girder bridge over Pleasant Run, Warren Township; and an arch bridge over Pogue's Run, Warren Township. Harry B. Smith, Auditor.

Iron Mountain, Mich.—The Board of Supervisors of Dickinson County has authorized a committee to confer with a like committee from Marinette County, Wis., with reference to procuring plans, specifications and bids for a bridge and its approaches across the Menominee River, near Quinnesec, Mich. Each county will bear one-half the expense and the committees will act in conjunction with each other. R. C. Browning, Clerk Dickinson County.

Jacksboro, Tenn.—The county officers have recently sold $100,000 worth of bonds which will be spent on building roads and eight bridges. W. R. Irish, Deputy County Clerk.

Jacksonville, Fla.—The Board of Public Works and the Jacksonville Street Ry. Co. are considering the question of a new viaduct.

Lafayette, Ind.—The following appropriations have been made by the County Councils: For a bridge over the Wea Creek, $4,200; bridge across the Little Wea, $1,125; number of small bridges in different parts of the county, $2,500; bridge over the middle fork of the Wildcat, $5,000; bridge across the south fork of the Wildcat, $5,000; bridge across Lauramie Creek, $1,000.

Laporte City, Iowa.—The County Supervisors have recently been at Laporte to consider the necessity of building a new county bridge to replace the one recently washed away.

Latonia, Ky.—It is said the Louisville & Nashville is having surveys made for a proposed overhead bridge to take the place of the arch at Ferry street. It is also said a bridge will be built over the Kentucky Central Junction.

Long Island City, N. Y.—The Long Island R. R. Co. is now receiving bids for the steel work on a bridge at Westbury.

The Board of Local Improvements, Newtown, has adopted a resolution to have a bridge built at Mary street and Metropolitan avenue, over the tracks of the Long Island R. R.

Manchester, Ky.—A steel bridge is proposed over Little Goose Creek at Manchester, but bids will not be wanted until next fall by F. J. Roberts, County Judge.

Mankato, Minn.—Bids are wanted July 14 for two bridges and for two stone piers. Address Edgar Weaver, County Auditor.

Marion, Kan.—Contracts will be let July 10 for a steel bridge over Doyle Creek about 3½ miles southwest of Peabody.

Martinsburg, W. Va.—A steel bridge about 160 ft. long is contemplated but the county wants suggestions and estimates before ordering. Address I. L. Bender, Clerk County Court.

Nevada, Mo.—Six new bridges will be built in Vernon County this summer. Address James Clack, Road and Bridge Commissioner.

New Castle, Ind.—It is said bids are wanted July 8 for eight steel bridges in various parts of the county.

Orange, Ind.—The Boards of Commissioners of Fayette and Rush Counties are about to advertise for bids for a bridge over Seines Creek, about a mile from this place.

Ord, Neb.—Bids are wanted July 15 for a bridge 320 ft. long over North Loup River, about two miles N. E. of North Loup. The kind of bridge to be built has not been decided. Contractors will probably be required to submit their own plans. Address the Clerk of Valley County.

Ottawa, Ont.—According to report Hon. A. G. Blair, Minister of Railroads, is arranging for the strengthening of bridges between Montreal and Levis.

Painesville, Ohio.—An election will be held July 15 to consider building a $30,000 bridge over Chagrin River at Willoughby Township. John E. Post, Commissioner.

Petrolia, Ont.—The city council has decided to build an iron bridge over Bear Creek.

Philadelphia, Pa.—Mr. Haddock, Director of Public Works, is reported as saying that plans and specifications for the proposed bridge over the Schuylkill River at Passyunk avenue are about finished, but the bridge can not be built as there is no money available. The cost will be about $1,000,000.

Pittsburgh, Pa.—It was recently reported that the Pennsylvania R. R. contemplates extensive improvements at East Liberty, Pittsburgh, which includes a steel viaduct over Silver Lake; also a bridge over the Allegheny River, either at Brilliant Station or Forty-third street.

An ordinance is under consideration providing for a culvert under Oakland street at Batavia street, in the Thirty-seventh Ward.

Pittsfield, Mass.—It is said that Messrs. Collins & Norton, of Springfield, are making the plans for the bridge at Dalton avenue. Estimated cost $14,000.

Portage-la-Prairie, Man.—The government has agreed to bear one-third of the cost of building a new bridge over the Assinniboine River.

Portland, N. Y.—It is said that the Erie & Central New York Ry. is about to let a contract for a steel bridge over Tioughnioga River.

Portland, Ore.—A large fire in this city on June 23 destroyed two spans of the Madison street bridge across the Willamette River; also the warehouse and freight depot of the Portland City & Oregon Street Ry.

Providence, R. I.—According to local report, the Board of Aldermen has concurred with the Common Council in appropriating $70,000 to build a bridge on the line of Chatlett and Egan streets.

Ritzville, Wash.—The Boards of County Commissioners of Adams and Whitman Counties are arranging to build a large bridge over Palouse River.

Rockford, Ill.—The County Board of Supervisors will soon spend about $11,600 on building three bridges.

Rome, N. Y.—The Common Council has ordered a new bridge built over the Mohawk River at East Dominick street.

The State Superintendent of Public Works will soon want bids on the bridge to cross the Erie Canal at South James street, this city.

Rushville, Ind.—All the bids on eight new bridges for Rush County exceeded the appropriations and were rejected by the County Commissioners. New bids will be wanted.

St. Louis, Mo.—In regard to the proposed third bridge over the Mississippi River between St. Louis and East St. Louis, we are told that the Third Bridge Company is pushing matters with the expectation of having the bridge built within the next year or year and a half, and to have it ready for use at the time of the opening of the World's fair in St. Louis.

San Bernardino, Cal.—We are told that the Board of Supervisors of San Bernardino County will probably be compelled to build from 500 to 1,000 ft. of bridges next fall and winter. The Board is now considering the style of bridges to be built. J. D. Glover, Chairman.

San Francisco, Cal.—The Atchison, Topeka & Santa Fe, in consideration of privileges granted to it by the city of San Francisco, has agreed to build a bridge over Channel street, on the line of Third street. It will be a drawbridge and cost about $70,000.

San Saba, Texas.—Plans, specifications and bids will soon be wanted on a bridge between San Saba and Burnwood, at a cost of about $8,000. John Seeber, County Judge.

Saugatuck, Mich.—The contract for the steel draw-bridge over the Kalamazoo to Douglas has been let to the National Bridge Co. of New York.

Sault Ste. Marie, Ont.—W. C. Nixon is receiving tenders, up to July 1, for a bridge over Root River.

Somers, Conn.—This town is considering building a new bridge over Scantic River at North Somers.

Springfield, Ill.—It is said a viaduct will be built over the Wabash tracks at Tenth and Cook streets.

Stockton, Cal.—Bids are wanted at 10 a.m., July 8, by Otto Grunsky, County Clerk, for a steel bridge 380 ft. long over McMullen Lake. The foundations are Cushing cylinders.

Tennessee.—The bridge proposed over the Tennessee River in Marion County by the Memphis & Chattanooga

Ry., we are told, will be built under the jurisdiction of C. H. Ackert, General Manager of the Southern Ry., Washington, D. C.

Toledo, Ohio.—The Council is considering building a liftbridge across Swan Creek at Lafayette street.

Toronto, Ont.—The city engineer has recommended that the Crawford street bridge be replaced by a new steel structure, at a cost of $15,000.

Urbana, Ill.—Bids are wanted July 1 for three highway bridges. Ira O. Baker, Engineer, Champaign, Ill.

Uxbridge, Ont.—The county council will probably rebuild Dobson bridge at Cannington and the Beaver River bridge at Beaverton.

Wapakoneta, Ohio.—The County Commissioners have rejected all bids for the steel liftbridge over the canal in St. Marys and want new bids by July 14.

Warren, Ohio.—Bids are wanted July 11 for an iron bridge over Mahoning River in Braceville. Chas. B. Selby, County Auditor.

Watertown, N. Y.—The city and the Black River Traction Co. are considering plans for a crossing on Main street. It is said the Traction Co. has offered to build an undergrade crossing.

White Haven, Md.—A company has been organized by J. M. Roberts, G. M. Catlin and others, to build a bridge over the Wicomico River at a cost of about $25,000.

Winona, Minn.—Bids are wanted July 14 for a steel highway bridge. Address G. P. Coleman, City Engineer.

Other Structures.

Atlanta, Ga.—Local reports say that the Southern Ry. will build a handsome passenger station near the Mitchell street viaduct.

Bay City, Mich.—Contract for the Pere Marquette station in Bay City has been let to Matthew Lamont and J. H. Tennant, of Bay City. The station will be 161 ft. long x 36 ft. wide, and two stories high.

Cartaret, N. J.—The Chrome Steel Works, which now has a plant in Brooklyn, N. Y., will build at Cartaret. It is proposed to build a steel works having openhearth and crucible furnaces.

Fresno, Cal.—The roundhouse of the Southern Pacific, and 12 locomotives were destroyed by fire June 23, causing a loss of about $200,000.

Guthrie, Okla. T.—The Missouri, Kansas & Texas has recently bought 75 acres of land adjoining its division terminals, where roundhouses and shops will be built. It is said that the Chicago, Rock Island & Pacific will build a $30,000 station at the corner of Harrison avenue and Vine street.

Jamaica, N. Y.—The Long Island R. R., according to report, will build a new passenger station in Jamaica.

Kansas City, Mo.—It is said the Missouri Pacific will consolidate the shops at Cypress, near Kansas City, Sedalia and Ossawatomie, Kan., at a new location in the east bottoms, Kansas City. It is said the new buildings will cost nearly $500,000; also that the plans for same have been finished.

Lebanon, Pa.—The Norristown Iron Co. contemplates moving its plant from Norristown to Lebanon, where a new plant will be built adjoining the East works of the American Iron & Steel Mfg. Co.

Lima, Ohio.—The Cincinnati, Hamilton & Dayton has been, for some time, considering enlarging the shops at Lima, but we are told that nothing definite has been decided in this respect. The cost of the proposed improvements will probably not reach $150,000, as reported.

McKeesport, Pa.—It is said the Seamless Tube Co. will enlarge its plant.

Massillon, Ohio.—It is said the Baltimore & Ohio will carry out the plans, with some modifications, for a new station in this city as originally planned for the Cleveland, Lorain & Wheeling.

New Castle, Pa.—It is said the Baltimore & Ohio contemplates erecting car shops and extending the yards at this place.

Portland, Ore.—Work has been begun on the boiler and engine house of the Portland City & Oregon R. R. Co.'s proposed car shops in this city. According to the report, additional contracts are to be let.

Rome, Ga.—The Southern Ry., according to report, has decided to build a new passenger station in East Rome.

Topeka, Kan.—The Atchison, Topeka & Santa Fe will, within two months, let contracts for building an addition to the present station.

Trenton, N. J.—The J. L. Mott Iron Works, now located at 133d street and Third avenue, New York City, has begun work in Trenton on a new plant. The New York City plant will be abandoned.

West Point, N. Y.—The conference committee appointed by the U. S. Senate and House of Representatives on the Military Academy Appropriation bill has agreed upon an appropriation of $5,500,000 as the fixed cost of the new buildings at West Point, the Senate receding from its amendment making the amount $1,000,000 more.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xviii.)

Superintendents' Association of Texas.

This Association held its annual meeting at Houston, June 10. President Charles B. Peck and the other officers were re-elected and Mr. Peck was also chosen to represent this Association in the Central Association of Railroad Officers, which holds its annual meeting at St. Clair, Mich., in July.

Freight Claim Association.

The Freight Claim Association held its annual meeting at Montreal, June 10 and 11. The President for the ensuing year is Mr. J. J. Hooper, of the Southern Railway; First Vice-President, A. E. Rosevear (G. T.); Second Vice-President, W. S. Taylor (Burlington); Secretary, W. P. Taylor (R., F. & P.), Richmond, Va.

Society of Naval Architects and Marine Engineers.

The Executive Committee of the Council invites correspondence concerning papers to be read at the tenth annual meeting in November next. As it is important that the papers should be in print 30 days before the meeting, members who desire to submit papers or who have suggestions to make are requested to communicate with the Secretary at their earliest convenience. The Council is authorized to offer a prize not exceeding $200 in value for the best paper upon some subject directly pertaining to Naval Architecture or Marine Engineering. Papers submitted in competition for the prize must be sent to the Secretary before October 1, and should be plainly addressed and marked in one corner "For Prize Competition," and underneath the motto or other distinguishing title of the sender. In a sealed envelope, similarly addressed, should be enclosed the name of the sender and his motto or distinguishing title.

National Railroad Master Blacksmiths' Association.

The annual convention will be held at the Wellington Hotel in Chicago, August 19, 20 and 21. The subjects for consideration are:

"Uniform Methods; or Reducing Blacksmithing to an Exact Science." S. Uren, Chairman.
"The Clean Shop; Does It Pay?" A. W. McCaslin, Chairman.
"Case Hardening." Wm. Hodgetts, Chairman.
"Flue Welding." W. W. McLellan, Chairman.
"Waste of Coal." M. S. Clark, Chairman.
"Frogs and Crossings." J. G. Jordan, Chairman.
"Track Tools." J. H. Hughes, Chairman.
"Repairs of Frames." W. C. Scofield, Chairman.
"Tools and Tool Steel." Benj. Burgess, Chairman.
"Tools and Formers." Geo. Tutbury, Chairman.
"Oil as Fuel." Thos. McNeal, Chairman.
"Springs, Making and Repairing." C. A. Miller, Chairman.
"The Oil Furnace; Best Form." G. H. Judy, Chairman.
"Best Form of Forge for Using Oil." T. Lace, Chairman.
"Repairing Broken Piston Rods; Is it a Good Practice?" Wm. Young, Chairman.

PERSONAL.

—Mr. A. Hewson, Secretary of the branch railroad companies controlled by the Pennsylvania Railroad, died June 19, aged 68 years.

—Mr. C. R. Emmerson has been appointed Engineer of the proposed tunnel under the St. Lawrence between Montreal and Longueuil.

—Mr. R. W. Huie, who recently resigned as Auditor of the Arkansas Southern, has accepted the General Managership of the South Arkansas Lumber Co., at Jonesboro, La.

—The nomination of Capt. William Crozier, U. S. A., to be Chief of Ordnance, with the rank of Brigadier General, which has been pending before the United States Senate since last December, was confirmed on June 20.

—Mr. George E. Terry, Assistant General Freight Agent of the New York Central & Hudson River, died at his home in Yonkers, Wednesday, June 18. Mr. Terry was born at Chenango, N. Y., Sept. 10, 1859, and entered railroad service in 1877. He has held the position of Assistant General Freight Agent of the Central for seven years, having been appointed to this position in 1895.

—Mr. A. T. Perkins, Superintendent of the Kansas City, St. Joseph & Council Bluffs Railroad Division of the Burlington System, was born at Brunswick, Me., in 1865; was educated at the Boston Latin School and Harvard College, graduating from the latter in 1887 and in October of that year began his railroad service in the general freight office of the Chicago, Burlington & Quincy. Mr. Perkins' whole career has been with the Burlington. Starting as a clerk he rose through various subordinate positions until 1897, when he was appointed Superintendent of Freight Terminals at St. Louis. This position he held for two years and at the end of that time he was made Superintendent of Terminals. Mr. Perkins received his present promotion on June 1, this year.

—The new Mechanical Engineer of the Chicago & Alton, Mr. John H. Leyonmarck, is a native of Sweden, having been born in Stockholm in 1859. After graduating from the Polytechnic Institute, Sweden, in 1878, Mr. Leyonmarck served as a machinist apprentice with the Government Railroad at Stockholm. He came to the United States in 1881 and entered the service of the Pennsylvania as a machinist in the Altoona shops in May, same year. For two years (1882-1884) he was with the New York, West Shore & Buffalo as a draftsman in the office of the Superintendent of Machinery at New York city. From 1884 to 1889 he held a similar position on the Philadelphia & Reading and the Union Pacific. From 1889 to 1896 he was Chief Draftsman for the Chicago, Rock Island & Pacific and later for the Seaboard Air Line. From this last position he went to the Denver & Rio Grande as Mechanical Engineer, from which position he has just resigned to go with the Chicago & Alton as above.

ELECTIONS AND APPOINTMENTS.

Bangor & Aroostook.—W. K. Hallett has been appointed Assistant Superintendent, with headquarters at Bangor, and J. B. McMann becomes Assistant Superintendent at Houlton.

Buffalo & Susquehanna.—C. R. Williams has been appointed General Master Mechanic, with headquarters at Galeton, Pa., succeeding W. A. Brown, resigned.

Burlington, Cedar Rapids & Northern.—See Chicago, Rock Island & Pacific.

Chesapeake & Ohio.—E. T. Morris, Division Engineer, with headquarters at Hinton, W. Va., has resigned.

Chicago & Alton.—E. Young, General Auditor of the Union Pacific, has been appointed General Auditor of the C. & A.

Chicago, Burlington & Quincy.—C. H. Cartlidge has been appointed Bridge Engineer, with headquarters at Chicago. Geo. H. Bremner becomes Engineer of the Illinois Lines, at Chicago, and Frank Beckwith becomes Engineer of the Iowa Lines, at Burlington.

Chicago, Peoria & Western.—B. F. Grubbs has been appointed Assistant General Freight Agent, with headquarters at Chicago, Ill.

Chicago, Rock Island & Pacific.—This company will be operated in districts, as follows: The lines heretofore comprising the Burlington, Cedar Rapids & Northern will be known as the Northern District. The lines east of the Missouri River will be known as the Eastern District. The lines west of the Missouri River will be known as the Western District. The Northern District will be divided into operating divisions, as follows: Robert Williams, heretofore Vice-President and General Superintendent of the Burlington, Cedar Rapids & Northern, will be General Superintendent, and F. Walters will be Superintendent of the Cedar Rapids Division, with headquarters at Cedar Rapids. O. H. McCarthy becomes Superintendent of the Iowa Falls Division, at Estherville, Iowa. T. H. Simmons, heretofore General Freight Agent of the Cedar Rapids road, is made Assistant General Freight Agent at Cedar Rapids; M. A. Patterson, heretofore General Freight Agent of the Rock Island & Peoria, becomes Assistant General Freight Agent of the C., R. I. & P.

W. W. Stevenson, heretofore General Auditor of the Central of New Jersey, has been appointed Controller of the C., R. I. & P.

Choctaw, Oklahoma & Gulf.—W. B. Leeds has been elected President, G. H. Crosby becomes Secretary, and F. E. Hayne Treasurer. This company was recently taken over by the Chicago, Rock Island & Pacific.

Cleveland, Cincinnati, Chicago & St. Louis.—R. H. Simpson, Engineer Maintenance of Way at Wabash, Ind., has been transferred to a similar position at Indianapolis, succeeding Hadley Baldwin, who has been assigned to special work. H. H. Knowlton has been appointed Engineer Maintenance of Way of the Michigan Division, and Paul Hamilton becomes Engineer Maintenance of Way of the Cairo Division. H. C. May has been appointed Division Master Mechanic, with headquarters at Louisville, Ky.

Dallas, Cleburne & Southwestern.—The officers of this company are: President and General Manager, W. D. Myers; Vice-President, C. C. Nelson; Secretary and Treasurer, W. A. McDonald, and Chief Engineer, H. A. Genung. (See Railroad Construction column.)

Denver & Rio Grande.—F. R. Clark has been appointed Superintendent of Bridges, with headquarters at Denver.

East & West.—The officers of this company, which recently came under the control of the Seaboard Air Line, are: President, J. S. Williams; Vice-President, J. M. Barr; Treasurer, J. H. Sharp, and Assistant Secretary, D. C. Porteous. The new directors, including those above mentioned, except Mr. Porteous and Mr. Sharp, are: J. W. Middendorf, F. R. Pemberton, W. T. Rosen, E. Kelly and G. J. Gillespie.

Eastern Texas.—P. A. McCarthy, heretofore Assistant Engineer, has been appointed Chief Engineer, with headquarters at Kennard, Texas, succeeding F. W. Valliant.

Evansville & Terre Haute.—F. P. Jeffries, heretofore General Freight and Passenger Agent, has been appointed General Manager, succeeding J. G. Metcalfe. (See Mexican International.)

Gulf, Beaumont & Kansas City.—J. R. Dillon has been appointed General Freight and Passenger Agent, with headquarters at Beaumont, Texas.

Mexican International.—J. G. Metcalfe, General Manager of the Evansville & Terre Haute, has been elected President of the M. I.

Philadelphia & Reading.—Edw. Shelah, Division Engineer, with headquarters at Reading, Pa., has resigned, to go to the Wabash.

Rock Island & Peoria.—See Chicago, Rock Island & Pacific.

St. Louis, Watkins & Gulf (Kansas City, Watkins & Gulf).—The officers of this company are: President, J. B. Watkins; Vice-President and General Manager, H. N. Kane, and Secretary and Treasurer, J. S. Thomson.

Union Pacific.—A Stewart has been appointed Master Mechanic, with headquarters at Cheyenne, Wyo., succeeding W. R. McKeen, Jr.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alabama Roads.—The Campbell Coal & Coke Co., of Atlanta, Ga., has bought the properties of the Needmore Coal Co., at Bridgeport, Ala., and it is said that they will build a railroad to open them up. The proposed line will be about 10 miles long.

Atlantic & Lake Superior.—An officer writes in regard to the current report that this line, which runs from a connection with the Intercolonial at Metapedia, Que., to New Carlisle, about 100 miles, will be extended to Port Daniel, 22 miles, that it is probable this will be undertaken in the future, but there is no present indication of its being done. (June 13, p. 453.)

Big Sandy, East Lynne & Guyan.—This company was incorporated at Charleston, W. Va., June 18, with a capital stock of $500,000, and proposes to build a railroad from the mouth of White's Creek, on the West Virginia side of the Big Sandy River, to Logan, W. Va., a distance of about 40 miles.

Brunswick & Birmingham.—Announcement is made that the extension to Nichols, in Coffee County, Ga., will be open for business on July 4.

Burlington & Western.—Work is now reported completed on the preparatory grading, etc., for the widening of this narrow gage line, which is to be finished on June 29. It is stated that this work can be done in less than 10 hours. (See Chicago, Burlington & Quincy, under Railroad News.)

Cane Belt.—An officer writes that contract has been let for the proposed extension from Bay City to Matagorda, Tex., 23½ miles, to Wm. C. Zelle, Lincoln Trust Co., St. Louis, Mo. Graders are now at work and the road will probably be completed within the next four months in time to handle this season's rice crop. W. T. Eldridge, Eagle Lake, Texas, is Vice-President and General Manager. (June 13, p. 453.)

Central of Georgia.—Surveys are reported resumed between Hollins, Ala., and Ashland, and it is said that the line will be pushed through as far as Carrollton, Ga., with a view to establishing a new line from Birmingham to the coast. Negotiations between the people of Hollins and the Central of Georgia have been in progress for some time. Hollins is 20 miles from Ashland and Carrollton is about 50 miles beyond.

Chicago & North Western.—An officer writes that the new Fremont, Elkhorn and Missouri Valley extension between Deadwood and Lead, S. Dak., about six miles long, was opened for traffic with daily trains on June 12.

Chicago, Rock Island & Pacific.—Announcement is made that a new east and west line is to be built from Enid, Okla. T., to a junction with the El Paso extension, somewhere north of Santa Rosa. The Choctaw, Oklahoma & Gulf is also to meet the El Paso line, and these two will be about 70 miles apart. Further particulars as to the letting of contracts, etc., are not available at the present time.

Dallas, Cleburne & Southwestern.—An officer writes that contracts for grading, track laying, bridges, etc., for this proposed line between Cleburne and Dallas, Texas, 50 miles, will be let within 10 days. The proposed route runs by way of Egan and Mansfield, and the road is also projected beyond Cleburne to Glen Rose. It is located between Cleburne and Egan. The work is light, with a 10 per cent. grade and maximum curvature of 4 deg.; 60-lb. rails will be used and the company is now ready to receive bids for rails and rolling stock.

W. D. Myers is President and General Manager and H. A. Genung Chief Engineer. (June 13, p. 453.)

Denver & Northwestern.—D. H. Moffat, President of the First National Bank of Denver, chief promoter of this proposed line between Denver and Salt Lake City, is quoted as saying that the necessary preliminary arrangements have been made and that the project has now advanced to the point where building can be done. In addition to $2,500,000 subscribed in the city of Denver, outside capital has also been secured and rails have been ordered. The general scheme of finance includes the issuing of $20,000,000 of bonds and $20,000,000 of stock, including preferred and common. Mr. Moffat is further quoted as saying that the road is not building for the purpose of entering into a competitive field or for the purpose of making a new road to the Pacific coast, but simply because it is felt that there is need for such a line between Denver and Salt Lake City. (May 30, p. 403.)

Des Moines Terminal.—An officer writes that this road, incorporated June 6 to build terminal tracks, etc., in Des Moines, proposes to operate by steam and that surveys are now in progress. Further than this no details are at present obtainable. F. M. Hubbell, of Des Moines, is President, and A. L. Morgan, Chief Engineer. (June 13, p. 453.)

Easton & Raubsville.—An officer writes that location is being made of this proposed line to run between Easton and Raubsville, Northampton County, Pa., five miles. Lewis P. Muthart, of Easton, Pa., is President, and Warren F. Cressman is Chief Engineer. (June 13, p. 454.)

East St. Louis & Lake Shore.—This company has been incorporated in Illinois to build from East St. Louis through the counties of St. Clair, Washington, Perry, Franklin, Saline and Hardin to Elizabethtown in Hardin County. The incorporators and first board of directors are: Wm. Ortgier, Geo. Ortgier and Wm. R. Drummond, of East St. Louis, and others. The principal office is at East St. Louis. The proposed line will parallel either the Illinois Central or the St. Louis & Southeastern.

Elk Valley & Midland.—Incorporation was granted this company in West Virginia, June 18, which proposes to build from Centralia at a junction with the Baltimore & Ohio, and extend the line into Pocahontas County, W. Va. The proposed terminus is not stated.

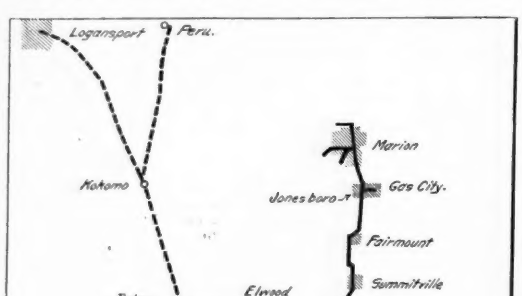
Florida Southeastern.—This company was incorporated, June 15, with the object of building a railroad from Tallahassee to Tampa, 300 miles. The new company is said to be composed chiefly of men interested in the Georgia, Florida & Alabama.

Franklin Southwestern Traction.—This company was incorporated in Indiana, June 17, with the purpose of building an electric line from Franklin, Ind., through Trafalgar, Nineveh and Morgantown to Nashville, a distance of about 35 miles. The Cleveland, Cincinnati, Chicago & St. Louis would be paralleled by the proposed line between Franklin and Morgantown. The directors are Wm. G. Irwin, Carl E. Willan, Thomas E. Valentine and others, of Indianapolis.

Illinois Central.—At a meeting of the directors, June 18, it was decided to increase the capital stock from $79,200,000 to $95,040,000, offering the new shares to present stockholders at par. This increase will require a special meeting of the stockholders for authorization, as the capital is at present limited to the amount now outstanding. The new funds realized are to be applied to the double tracking of the main line between Chicago and New Orleans, mentioned at various times previously in our issues, and also to improve terminal facilities. It is said that there is also a prospect of new extensions of the lines northwest of Chicago.

Illinois Valley Belt.—This company has been incorporated in Illinois to build a belt road in Tazewell County, Ill., between Peoria and Pekin. The principal office is in Chicago and the incorporators and first board of directors are Gordon J. Murray, Robert J. Slater and others, of Chicago.

Indianapolis Northern Traction.—An officer writes concerning this company, incorporated April 15, in Indiana, as a consolidation of a number of electric interests in different cities north of Indianapolis, that the proposed route, as shown on the accompanying map, is from Indianapolis north by way of Noblesville, Tipton and



Kokomo to Logansport, with lines from Kokomo to Peru and from Tipton east to Elwood, a total distance of about 104 miles. Ellis C. Carpenter, Anderson, Ind., is President, and W. A. Richardson, Noblesville, Ind., Chief Engineer. Geo. F. McCulloch is General Manager. The heavy line on the map is the present system of the Union Traction Co., and the broken line shows the new route as it will be when completed. (April 25, p. 316.)

Jefferson City & Memphis.—Further particulars received regarding the surveys reported in the interest of the Chicago, Rock Island & Pacific for a line southwest from Rolla, Mo., to the Arkansas line, indicates that this is part of a project under the above title. The distance from Jefferson City, Mo., to Memphis, Tenn., is 269 miles over the route proposed, through a productive country. Colonel S. T. Emerson is Chief Engineer and reports that work will begin at once on the new line and that the Chicago, Rock Island & Pacific is interested in it. (June 20, p. 485.)

Lake Hancock & Claremont.—Most recent advices state that eight miles have already been built of this line, which was recently incorporated in Florida to build from Lake Hancock through Polk and Lake counties to Claremont, which is about 55 miles distant. The property in its present condition is practically owned by W. J. Carter, of Carters, Fla., who intends to build it section by section as it is needed. (June 20, p. 486.)

Long Island.—An officer writes that the matter of depressing or elevating the tracks between Bay Ridge and East New York has not yet reached a point where any details can be published.

Mason City & Fort Dodge.—New articles of incorporation of this company were filed in Iowa, June 13. The articles state that the principal place of business is to be Oelwein, Iowa. The general nature of the business is to build a railroad from a connection with the Chicago Great Western at or near Oelwein, Fayette County, Iowa, to Waverly, Bremer County, and to acquire by purchase, lease or otherwise the other railroads in Iowa. John L. Pratt is President.

Mexican Central.—An engineering party is now reported to be in the field making surveys for a branch from San Juan, on the Gulf Division of the Mexican Central, to the mining town of Cerralve, in the State of Tamaulipas. The Mexican National, some months ago, obtained a concession from the Mexican Government for a road between Monterey and Matamoras. This road is also to pass through Cerralve, and it is believed that the proposed branch of the Mexican Central will not stop at that point but will be continued to Laredo, where it will connect with a proposed extension of the St. Louis & San Francisco. No official statement in regard to this has as yet been made, however.

Mexican National.—It is said that the company proposes to build 155 miles of new standard gage line during the ensuing year. The line from Laredo to Monterey, 168 miles, will be completed by Sept. 1. A cut-off, 155 miles long, is to be built from Soria, the southern terminus of the projected standard gage works, to Huehuetoca, south of El Salto, on the Southern Division. This cut-off will save 40 miles, besides reducing grade and curvature. The maximum grade on the line will be 1½ deg., as against 4 deg. or more on the old.

Mexico Roads.—The Nichols Chemical Co., of New York, which has extensive mining interests in Mexico, is having a survey made for a railroad from the San Jose mines, in the State of Tamaulipas, Mex., to a connection with the Gulf Division of the Mexican Central. This road will be about 53 miles long.

Missouri, Kansas & Texas.—Announcement is made that negotiations have been completed to purchase right of way and franchise of the Trinity, Cameron & Western, a line which was promoted several years ago by former Governor Hogg. Thirty miles of grade between Georgetown and Granger, Tex., were completed, after which the company met with financial difficulties and abandoned the project. It is said that the present plans involve a connection at Trinity with the isolated piece of road running between Trinity and Colmesniel, 75 miles, and operated by the Missouri, Kansas & Texas, and that this line will be extended east to a connection with the Orange & Northwestern. The plans, as indicated, will involve building 150 or more miles of new track, including the connection between Georgetown and Trinity.

Ohio Valley Traction.—This company has been incorporated in Kentucky to build an electric line from Milton, in Trimble County, Ky., through Trimble, Carroll, Gallatin, Boone and Kenton counties, Ky., to Cincinnati, a distance of about 85 miles. The incorporators are M. I. Barker, R. M. Barker and J. S. Jett, of Carrollton, and others.

Orange & Northwestern.—An amendment to the charter was filed at Austin, Texas, on June 17, which provides for building 350 miles of additional track in Texas. The extensions proposed are from Buna to Corsicana, 195 miles, passing through the counties of Jasper, Angelina, Trinity, Houston, Anderson, Freestone and Navarre; also from a point on the eastern boundary of Jasper County, northwest to Marshall, Texas, 150 miles, passing through the counties of Newton, Jasper, San Augustine, Sabine, Shelby, Panola and Harrison, and from Orange to West Orange, five miles. The line is now in operation between Orange and Buna, 30 miles. The general office is at Orange, Texas. (Jan. 10, p. 32.)

Patchogue-Port Jefferson (Electric).—Plans are reported practically completed for an electric road to cross Long Island from Port Jefferson, on the Sound, to Patchogue, on the South Shore, a distance of about 13 miles. This is about the center of Long Island and there is a great lack of transportation facilities at present between the north and south shores.

Pennsylvania.—It is said that the connection between the Pittsburgh, Virginia & Charleston and the Monongahela Connecting R. R. in Pittsburgh will be completed in October at a cost of $3,500,000, of which $2,000,000 was for the property. The work includes four tracks, the lowering of grades, removal of curves and of some grade crossings. The work is being done by Drake & Stratton. (Feb. 14, p. 122.)

Philadelphia & Reading.—An officer denies current press reports that there is any likelihood of a line being built from Downington, Pa., to Lancaster and Harrisburg.

Richmond & Northwestern Electric.—Articles of incorporation were filed in Indiana, June 7, for an electric road from Richmond to Anderson, a distance of 50 miles. The incorporators are G. M. Hodges, Dayton, Ohio; T. B. Milliken, New Castle, Ind., and others.

St. Louis & San Francisco.—Announcement is made that $1,000,000 is to be spent on improvements of the Birmingham Belt Line, recently purchased. The work to be done includes new track, additional rolling stock, etc., and it is said that the division between Memphis and Birmingham will be greatly improved and a new freight depot will be built at Birmingham.

San Francisco, Oakland & San Jose.—See Railroad News column.

Sierra Valley.—This is the correct name of the line which is now building from Jamestown to Angeles, Cal., 19 miles, and which has previously been referred to as the Sierra of California. According to newest advices, the road is now completed within a mile of Angeles and will probably be in operation by July 1.

Sioux Falls & Madison.—This company filed articles of incorporation in South Dakota, June 16, with a capital of $2,600,000. It is proposed to build a railroad 50 miles long in Minnehaha and Lake counties, S. Dak. The directors are Geo. Schlosser, F. Sherman and others.

Souderton-Trooper (Electric).—A company has been formed in Pennsylvania to build an electric line between Souderton, on the North Penn. R. R., and Trooper, on the Schuylkill Valley Traction line, passing through Franconia, Skippack and other towns, a distance of about 16 miles. The country traversed is without railroad facilities. The directors are E. S. Moser, Collegeville, Pa.; H. W. Reiff, Lederachville, Pa., and others.

Suburban Belt & Terminal (St. Louis).—Charter has been granted this company in Illinois to build from East St. Louis in a southeasterly direction through the counties of St. Clair, Madison and Monroe to a point on the Mississippi River opposite Crystal City, Mo. The chief office is at East St. Louis and the incorporators are E. A. Faulhaber, of Nashville, Tenn., and others.

Temosachic-Minaca.—It is said that a number of Mexican capitalists headed by Enrique Creel, a banker of Chihuahua, Mexico, will build a narrow gage road from Temosachic, which is situated in the center of a large range, to a connection with the Chihuahua & Pacific road at Minaca, about 150 miles distant. A section which is said to be rich in minerals will be passed through.

Vinton, Belle Plaine & Independence Interurban.—This company was organized in Iowa, June 20, to build an electric line between the points named, 50 miles. The principal place of business is Vinton, and the incorporators are Arthur Jones, Chas. S. Jones and others.

Wabash.—Surveys are reported for a projected connection with the Union R. R. According to present plans, a line will be built from a point near Carnegie, on the main line of the Wabash Pittsburgh extension, to a connection with the projected Monongahela Southern at Finleyville, 13 miles. The last-named road connects with the Union R. R.

Washington Roads (Electric).—It is said that franchise has been granted for an electric road through Snohomish County. A bond of $10,000 has been deposited that 20 miles of the road will be built within two years, through Snohomish, Sultan, Lake, Crescent and other towns. The franchise was granted to Dr. De Soto. Address not stated.

West Virginia Roads.—An officer writes that the Pleasant Creek Coal Co., of Fairmount, W. Va., will build a railroad eight miles long to a connection with the Baltimore & Ohio. A. Brady, Clarksburg, W. Va., is Chief Engineer in charge of construction.

GENERAL RAILROAD NEWS.

Baltimore & Ohio.—Purchase is announced of the Pittsburgh & Connellsville, a road 12 miles long, between Connellsville and Uniontown, Pa. The stockholders were paid $150 per share, the par value being $50. The road was leased some time ago to the Baltimore & Ohio, and legal difficulties had arisen out of the default of payment during the receivership.

Burlington Railway & Light.—$500,000 of the $750,000 first mortgage 5 per cent. bonds of 1897, $125,000 of which are reserved for future extensions, are offered at 101½ by Mason, Lewis & Co. A new franchise, which runs for 25 years from next fall, has just been granted. The property and franchise of the company were purchased a short time ago from the Peoples' Gas & Electric Co., of Burlington, Iowa, which is possessed of a number of valuable franchises, and guarantees the above mentioned bonds.

Canadian Pacific.—The Hull Electric Line between Ottawa and Aylmer, about 10 miles, has been taken over by the Ottawa Northern & Western, recently acquired by the Canadian Pacific. It is said that the price will be between $700,000 and $800,000.

Chicago, Burlington & Quincy.—At the annual meeting of shareholders of the Burlington & Northwestern it was voted to sell the property to the Burlington & Western. Both of these lines are controlled by the Chicago, Burlington & Quincy. The Burlington & Northwestern is a narrow gage line extending from Mediapolis to Washington, Iowa, 39 miles, and by means of a third rail trains return over the Burlington, Cedar Rapids & Northern between Mediapolis and Burlington, 14 miles. The Burlington & Western runs from Winfield to Oskaloosa, Iowa, 71 miles, and has trackage rights over the Burlington & Northwestern between Burlington and Winfield, 33 miles, under the present arrangement. T. W. Barhydt is President of both of these subsidiary companies at the present time.

Lexington & Big Sandy.—This company will be formed July 1 as a consolidation of the Elizabethtown, Lexington & Big Sandy, the Kentucky & South Atlantic, the Ohio & Big Sandy and the Ohio River & Charleston railroads. It is provided that the new company may ultimately go into the hands of the Chesapeake & Ohio. At the present time the Elizabethtown, Lexington & Big Sandy, operating 124 miles of line, including 21 miles of trackage; the Kentucky & South Atlantic, with a line 19 miles long, and the Ohio & Big Sandy, 48 miles long, are proprietary companies of the Chesapeake & Ohio. The Ohio River & Charleston is an independent line 8½ miles long. The capital of the new consolidation will be $4,800,000, and the directors are all officers of the Chesapeake & Ohio.

Missouri, Kansas & Texas.—See Railroad Construction column.

San Francisco, Oakland & San Jose.—This company was incorporated in California, June 12, as a consolidation of the Oakland & San Jose, incorporated last November, and the San Francisco & Piedmont, incorporated last December. Each of the companies concerned has a capitalization of $2,500,000, making a consolidated capitalization of $5,000,000. The original incorporation of the Oakland & San Jose provides for a line between the points named, 50 miles, with branches, one to Los Gatos, 15 miles; another to Saratoga, 15 miles, and north to Santa Clara, three miles, making a total of 83 miles. This route is not to be changed under the new regime. The San Francisco & Piedmont was incorporated to run an opposition ferry system between Oakland and San Francisco, including an electric tunnel railroad, with its terminus near Goat Island, the total length to be about 17 miles. The directors of the two corporations were the same, being stockholders of the Realty Syndicate, which owns the Oakland Transit Co. and the Oakland Street Car Line on that side of the bay. By the terms of incorporation, either steam or electricity may be used to operate trains.